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THE
LIFE OF A BIRD.

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THE

LIFE OF A BIRD;

AN ACCOUNT OF

THE PROGRESS OF BIRDS FROM THE NEST TO THEIR
PERFECT CONDITION.

PUBLISHED UNDER THE DIRECTION OF
THE COMMITTEE OF GENERAL LITERATURE AND EDUCATION,
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The first object of the Commission was to
ascertain the extent of the damage done
to the property of the State by the
floods of 1876. It was also to
ascertain the causes of the damage
and to propose measures for its prevention
in the future.

The Commission was organized on the 1st
of March 1877. It consisted of
seven members, of whom the Governor
was the President. The members
were: the Governor, the Secretary
of the State, the Attorney General,
the Chief Justice of the Supreme
Court, the President of the Senate,
and the President of the House of
Representatives.

THE LIFE OF A BIRD.



PART I.—THE NEST.



CHAPTER I.

THE SITUATION.

THE situations which birds of different species and orders fix upon for the foundation of the dwelling-place of their young are extremely various, and lie among the deep recesses of the forest, in the pleasanter alleys of the greenwood, in the hedge-row, the bank-side, the crevices of the rock, the borders of the lake, the solitary mountain and moor. Thither let us follow them, and trace these busy architects in their operations.

The plan upon which we propose to proceed in

the present volume is, first, to watch the actions of various birds, in the foundation and construction of their nests, then to watch the dawn of life in the egg, its development in the chick, and finally, to offer some account of the structure and characters of a perfect bird. Thus we shall have the pleasure of commencing the study of Ornithology—that is, the history of birds—at the beginning; and having learned what is to be learned upon the history of any bird, we shall be well prepared to enter upon the higher task of arranging these beautiful creatures into orders, tribes, and families. Our present chapter will be confined chiefly to a notice of the various situations selected by birds for their nests.

“The construction and selected situations of the nests of birds,” observes Mr. Knapp, “are as remarkable as the variety of materials employed in them; the same forms, places, and articles being rarely, perhaps never, found united by the different species which we should suppose similar necessities would direct to a uniform provision. Birds that build early in the spring seem to require warmth and shelter for their young; and the blackbird and the thrush line their nests with

a plaster of loam, perfectly excluding, by these cottage-like walls, the keen icy gales of our opening year. Yet, should accident bereave the parents of their first hopes, they will construct another, even when summer is far advanced, upon the model of their first erection, and with the same precaution against severe weather, when all necessity for such provision has ceased, and the usual temperature of the season rather requiring coolness and free circulation of air. . . . The greenfinch places its nest in the hedge, with little regard to concealment. Its fabric is slovenly and rude, and the materials of the coarsest kinds; while the chaffinch, just above it in the stem, hides its nest with cautious care, and moulds it with the utmost attention to order, neatness, and form. One bird must have a hole in the ground; to another a crevice in the wall or a chink in a tree is indispensable. . . . Endless examples might be found of the dissimilarity of requirements in these constructions among the several associates of our groves, our hedges, and our houses; and yet the supposition cannot be entertained for a moment, that they are superfluous, or not essential for some purpose with which we are unacquainted. By

how many of the ordinations of Supreme Intelligence is our ignorance made manifest! Even the fabrication of the nests of these little animals exceeds our comprehension." These remarks are just; yet we are presented in nature with a large number of instances in which it is easy to trace the motives of these little architects, and the beautiful evidences of intelligence and instinct which they manifest in the selection of both situation and materials for the fabrication of their nests, and the peculiar adaptation of the latter to the habits of the parent and the wants of the young.

Trees form favourite sites for the erection of nests. Seated on the summit of a cypress tree, not far from the clear waters that bathe the shores of the Floridas, one hundred and thirty, or one hundred and forty feet high, the great egret of America builds her nest—a large flat bundle of sticks rudely laid together. Yet the same bird also selects the mangroves bordering the great dismal swamps swarming with loathsome reptiles, and scarce six feet above the water lays her rude and inelegant cradle for the reception of her future offspring. The turtle dove also chooses the tall trees of the forest for her nest. This structure is

placed upon the summit, or highest branches of the highest trees, in the most silent forest-depths, and consists simply of a flat bundle of twigs somewhat intertwined, upon which the bird deposits her eggs and rears her young. The heron makes choice of the tall cedars of America, in the midst of the swamps, for the situation of her nest. In the Carolinas, where herons of all sorts are abundant, they breed in considerable numbers. "Imagine, if you can," writes Mr. Audubon, "an area of some hundred acres overgrown with huge cypress trees, the trunks of which, rising to a height of perhaps fifty feet before they send off a branch, spring from the midst of the dark muddy waters. Their broad tops, placed close together, with interlaced branches, seem intent on separating the heavens from the earth. Beneath their dark canopy scarcely a single sunbeam ever makes its way; the mire is covered with fallen logs, on which grow matted grasses and lichens, and the deeper parts with nymphœæ and other aquatic plants. The congo snake and water mocassin glide before you as they seek to elude your sight; hundreds of turtles drop, as if shot, from the floating trunks of the fallen trees, from which also the sullen

alligator plunges into the dismal pool. The air is pregnant with pestilence, but alive with mosquitos and other insects. The croaking of the frogs, joined with the hoarse cries of the auhingas, and the screams of the herons, form fit music for such a scene."* In such a spot, where the foot of man seldom falls, and where the tumult of the life of nature is most abundantly heard, the heron places on the tall trees her large flat nest. A very different situation is selected by the rook. This bird, far from avoiding, appears even to court human society. No place is more suitable than the neighbourhood of an old family mansion, deep embowered in the woods. Not a hundred yards from the outer offices, where a grove of tall forest-trees shoot up into the sky, casting its broad shadows over the coppice below, the rookery will be placed.

Many birds, however, having less exalted notions, select humbler trees for the situation of their nests. For a number of illustrations in point we have only in early spring to take a walk through the orchard, or along the skirt of the wood. It will not be long before we detect the objects of

* Audubon : Ornithological Biography.

our search in many a carefully chosen lurking place among the leaves of the bough, or nestling against the lichen-covered trunk, just where a stout arm of the tree juts out so as to leave a resting-place at its junction with the tree. The beautifully-felted nest of the goldfinch lies snugly seated on a shady branch, all wrought so smooth and even as to present a perfect picture of neatness. Upon an aged apple-tree, the bark of which is heavy with moss and greyish lichens, in a fork of one of its branches, is the not less beautiful structure of the chaffinch. There, bound together and to the surrounding branches by bands of moss and wool, this fabric is fixed with its contents; and there the anxiously glistening eye of the parent may often be seen keenly observing the intruder. The American water-thrush places her structure at the very foot and amongst the roots of trees, or by the side of a decayed log, where it is very easily discovered. While the mother tends her task of incubation, her musical mate is often seen perched on a low bough, and pouring forth music which has been compared to a successive running down two octaves on the pianoforte.* Of our

* Audubon.

familiar friend, the redbreast, it has been justly said,—

“High is his perch, but humble is his home;”

it generally lies at the root of trees, often overshadowed with high blades of grass, or overhanging clusters of moss. Sometimes

“Close at the root of brier-bush, that o’erhangs
The narrow stream, with shealings bedded white,
He fixes his abode.”

The situations selected by birds which do not build in trees, or at their foot, among the vegetation clustering on the ground, are extremely various, and frequently not the same for the same species. The swallow places its dwelling near our own; while the bank-swallow seeks the friable surface of the sand-cliff, and there with wonderful patience forms its gallery, and at its further extremity deposits the loose materials of its nest. Under the shelter of the haystack the wren often builds; yet not unfrequently some other site is selected for this purpose. The daw has an antiquarian taste, and loves to fix its abode in ruined castles or abbeys, or in some ivy-mantled church-steeple. Sometimes even rooks select the

same places: and the battlements of Windsor Castle were at one time crowded with these vociferous tenants. Many birds make choice of the ground for the situation of their nests. The Loon, which abounds in several parts of the United States, places it upon hillocks of weeds and mud, prepared by the musk-rat, on the edges of the lakes. Other nests are situated actually upon the mud, among the rank weeds, not far from the water. Audubon saw one such nest, after the young had left it, almost afloat, and rudely attached to the rushes; its base being placed on the bottom, eight or nine inches under water. The crevices of the rocks are the sheltering places of others. Others place their nests on the moor; others on the naked surface of cliffs. To some the river-side, to others the desolate sea-shore, affords a favourite site. And while some unconcernedly expose their fabric to the glare of day, others burrow into the earth, and there, in a dark and silent cave, bring forth the egg and tend the young. While some also delight to hang their fairy-like nests in the branches of trees; others tunnel into the trunk, and in a wooden cell pass the anxious time of parentage.

The instances we shall proceed to select will shew how remarkably various are the situations of nests, and, in some cases, how ludicrously they are placed. Yet in all we have an exhibition of constructive skill and ingenuity, which may well excite our attentive consideration. It may be true, as has been stated by Gilbert White, that birds are generally wise in their choice of a situation; but sometimes their wisdom appears more than questionable. The tomtit is a conspicuous example of this: this bird has been frequently known to build its nest in the interior of an old pump; an anecdote is, in fact, told of one which suffered its tail to be actually rubbed off by the constant friction of the handle! The same birds have been known to build inside a garden flower-pot, forgetting the difficulty their young ones must have to experience in getting out of the drain-hole, as the pot was inverted. Fortunately, the pot was accidentally lifted, and the feathered captives were set free. Audubon gives an instance of a house-wren building its nest in an old hat.

The following singular account is related by the Rev. W. T. Bree. "A few years ago a pair of robins took up their abode in the parish church of



Hampton in Arden, Warwickshire, and for two years in succession affixed their nest to the church Bible as it lay on the reading-desk. The worthy vicar would on no account have the birds disturbed; and accordingly introduced into the church another Bible, from which to read the Lessons."

It appears that the birds plundered the rope-ends out of the belfry for materials for their nest. The old women of the village omened badly for the fate of the tender-hearted protector of the birds, and, as if to confirm their augury, he died in the

second year after the birds began to build in the church.

In a number of the Bolton Chronicle for 1830, is the following statement:—"There is now in the yard of —— a robin sitting upon five eggs, which had chosen for the situation of its nest the nave of an old cart-wheel!" They have been also known to build their nests in the fold of a bed-curtain, where they have been kindly permitted also to rear their young. At Fort William, near Belfast, a gentleman has stated that one of these birds built its nest in his pantry. The place selected was the corner of a moderately high shelf, among bottles, which being four-sided gave the nest the singular appearance exteriorly of a perfect square. It was made of moss, and lined with a little black hair; and on the side exposed to view were dead beech leaves. Here five eggs were laid, which proved unfruitful. The bird still continued to visit the place, but now resorted to a room above the apartment, which was occupied for the purpose of stuffing birds. Being often expelled, and still persisting in its returns, the bird came to be looked upon as a troublesome visitor, and it was determined to frighten it away. In this room

was a collection of Asiatic quadrupeds stuffed; of these the most ferocious and appalling-looking were selected and placed at the window. Doubtless any other intruder would have retired from such awful society; but the stout-hearted robin, not the least intimidated, paid its visits as usual. The bird was at length permitted to have its own way, and, as if still further to show that it had no coward's heart, it actually selected for its nest the head of a shark, under cover of the tail of an alligator which overshadowed it as it hung upon the wall. Here its eggs were deposited, and its young hatched, which in due time were conducted into the open air by the intrepid parent.*

The swallow makes choice of the most singular situations for its nest, perhaps, of any bird. A pair of these birds has been known to build their nest in a schoolroom where there were forty scholars, the windows having been accidentally left down. They used to build even during school-hours, and successfully prosecuted the duties of parentage, taking their young ones with them out of the room when they were able to fly.

* Mr. W. Thompson: *Annals of Natural History*.

About five or six feet down the inside of a wide, circular chimney at Cowie distillery, about five miles from Stirling, for some time past, three or four pairs of swallows have annually built their nests. Upon the inside of the roof of the coolers at the same place, which is 250 feet long by 50 in breadth, upwards of a hundred pairs of them for many years have erected their habitations and reared their offspring. A more singular situation still is also recorded. In the inside of the large wooden vane of Bridgehaugh Mill, Berwickshire, for fourteen successive years a pair took up their residence. The original nest is still remaining. Upon it, during that long period, there have been only two other nests built, which are ranged one above another, and formed of mud and straw. For several seasons the young of this devoted pair were smothered with the smoke of a fire which is kindled during summer for the purpose of drying the corn. At length the pair quitted their habitation, and built another upon the side of the wall at no great distance from it. In a house which was for some time unoccupied, and the door of which was left slightly ajar for the

purpose of ventilation, a pair of these birds built their nest upon two wooden pegs fastened to the wall of the laundry. Sometimes they select the shafts of coal mines for their labours. They have been seen at the depth of two, three, and nearly four fathoms. Of the banksmen and colliers they appear to be perfectly regardless; even the hatches, which are often drawn up and down, do not annoy them. They have been seen by the men going to or returning from their work, performing the duties of incubation at times when the shaft has been full of smoke, altogether indifferent to the circumstance. A few years ago a man lost his hand in the act of robbing a nest of the young in a coal pit, the hatch, or lifting apparatus, upon which he was standing, having been suddenly drawn up at the time. This nest was stated to be at the astonishing depth of fifteen fathoms!

Mr. Jesse mentions the following interesting anecdote of the same bird.—“Having occasion myself to call some years ago on the Rev. Egerton Bagot, of Pipe Hayes, in Warwickshire, I was surprised at seeing a swallow’s nest built on the knocker of his hall-door, and the parent bird in the act of incubation. When the door was opened

(a circumstance which occurred frequently in the course of the day) the bird left her nest for an instant, but returned to it as soon as it was shut. I afterwards learnt that the swallow hatched, and that her young arrived at maturity.*

The swallow has been known to build her nest in the handles of a pair of garden-shears, and in the body of a dead owl. The Welcome swallow of Australia naturally builds in deep clefts of rocks and dark caverns. Singular to relate, however, since the colonization of that country it has selected the smoking chimneys and dwellings of man. In out-houses and shady verandahs its nest, which is open at the top, is now frequently to be seen.

The martin (*hirundo urbica*) is said to have a strong predilection for old houses: but this is by no means generally true, as the martin often builds against houses recently erected. Sometimes it will build its nest upon precipices steep and inaccessible, in preference to erecting them upon modern houses which may be in the neighbourhood. In the picturesque vicinity of Portstewart, Londonderry, Mr. W. Thompson noticed that martins

* Jesse : Gleanings, &c.

were always to be seen gliding to and from their nests, beneath the summit of a stupendous basaltic arch that rises at the base of the isolated rock in which the ruin of a castle is situated. Undismayed by the war of the waves of the Atlantic which thunder with indescribable fury upon the north-east coast of Ireland, these birds may be seen playing around the high basaltic rocks in whose recesses their nests are contained. Swifts have a great love for antiquity, and delight to select as the situation for their nest the "rents of ruin" made by time in old towers, houses, and castles. They also love the shelter of the old-fashioned straw thatch.

The Frontispiece to this part represents a very pretty scene, drawn in the exquisite work of Mr. Gould on Australian Birds, and affords an interesting illustration of the situation of the nests of birds. He remarks: "One of the most interesting points connected with the history of this species (the yellow-throated *Sericornis*) is the situation chosen for its nest. All those who have rambled in the Australian forests must have observed, that, in their more dense and humid parts, an atmosphere peculiarly adapted for the rapid and abundant

growth of mosses of various kinds is generated, and that these mosses not only grow upon the trunks of decayed trees, but are often accumulated in large masses at the extremities of the drooping branches. These masses often become of sufficient size to admit of the bird constructing its nest in the centre of them, with so much art, that it is impossible to distinguish it from any of the other pendulous masses in the vicinity. These bunches are frequently a yard in length, and in some instances hang so near the ground as to strike the head of the explorer during his rambles. In others they are placed high up upon the trees, but only in such parts of the forest where there is an open space entirely shaded by overhanging foliage. As will be readily conceived, in whatever situations they are met with, they at all times form a remarkable and conspicuous feature in the landscape. Although the nest is constantly agitated by the wind, and liable to be shaken when the tree is disturbed, so secure does the inmate consider itself from danger or intrusion of any kind, that I have frequently captured the female while sitting on her eggs; a feat that may always be accomplished by carefully placing the hand

over the entrance; that is, if it can be detected; to effect which no slight degree of close prying and examination is necessary. The nest is formed of the inner bark of trees, intermingled with green moss, which soon vegetates. Sometimes dried grasses and fibrous roots form part of the materials of which it is composed, and it is warmly lined with feathers." *

Few situations are more remarkable than that selected by the dipper, or water-ouzel, for its nest. This little bird, finding its food at the bottom of shallow streamlets, is capable of enduring temporary submersion without injury; what we have to relate, therefore, as to the locality of its nest will not surprise the reader. Its nest may often be found in parts of Wales under the following circumstances. At the head of a ravine a wall of rock will be placed, over the summit of which a mountain stream pours down in a foaming cascade. The waters leap from the edge of the rock, and so leave behind them a dry portion of the front of the rock, where several little moss-covered nooks and recesses are found. Here the nest will be found. The nest itself is, in such circumstances,

* Gould: Birds of Australia.

formed of a mass of closely interwoven moss, seven or eight inches deep, and ten or twelve inches in diameter, with a hollow chamber in



the centre, lined with a few dry leaves. The entrance is a small aperture placed on one side. There can be no access to this spot but through the falling sheet of water which perpetually foams over in front, but seldom drops a spray

upon this recess; and the nest is as warm and dry as if placed in a tree far from the water. Sheltered from view by this liquid curtain the dipper sits secure—more secure, in fact, than many of our ancestors who fortified their castles with drawbridge and moat. When the bird seeks to leave or return to her home, she can only do so by at each time plunging through the falling torrent, which she does without any apparent difficulty.

An interesting instance of strange choice in the selection of a site for the nest is represented in the next page. A bird has in this instance built its nest within a cocoa-nut shell. The specimen from which this drawing was taken is in a private collection.

Sparrows are noted for the singular places they choose for their nests. Aware of their odd propensity, a gentleman in the country used to hang pots of various kinds about his premises in large numbers, which were well frequented by the sparrows, and supplied his table with birds for sparrow-dumplings not unfrequently during the year.

The most touching incident in the Life of a



Bird that could have taken place is recorded in "The Illustrated London News" for January 1844, accompanied with an illustration, which we shall copy :—"The principal external ornament of the Rotunda, in Sackville Street, Dublin, is a richly-carved frieze representing the heads of oxen, with festoons of flowers pendent from the horns, the frieze running round the building at a great eleva-

tion. In the hollow of the eye of one of these heads a sparrow built its nest. But amongst the materials which it employed for that purpose there



unhappily chanced to be a woollen thread, with a noose at one end. By some accident the poor little fellow unfortunately got his own neck inserted in the noose, and, in his efforts to extricate himself,

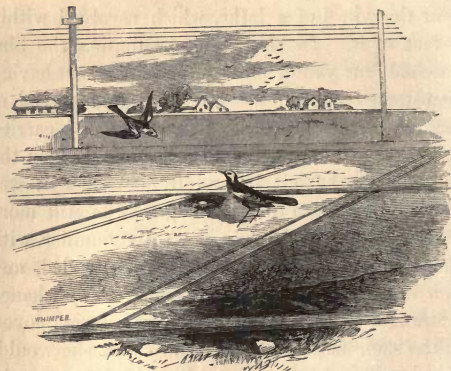
fell from his nest, and hung suspended below it. He was observed for some time making prodigious exertions to escape, but in vain; and his remains are now to be seen gibbeted at his own door, and fluttering in the wind, whilst the straws of his nest project from the eye-hole above his head."

The sparrow is not the only bird that builds its nest amid the bustle of human society. An instance is recorded of a pair of spotted-fly-catchers having built on the angle of a lamp-post in one of the streets of Leeds, and there rearing their young. Mr. Jesse, in the Second Part of his "Gleanings," mentions a nest of the same bird which was found on the top of a street-lamp near Portland Place, in London. It had five eggs in it, which had been sat upon. Mr. Yarrell states that he saw a nest of this bird fixed in the ornamental crown on the top of the lamp at the office of Woods & Forests, in Whitehall Place. Mr. Jesse makes mention of a still more singular site of a nest, but belonging to the water-wagtail. This bird took a fancy to one of the workshops of a manufactory at Taunton. "The room was occupied by braziers, and the noise produced by them was loud and incessant. The nest was built

near the wheel of a lathe, which revolved within a foot of it. In this strange situation the bird hatched four young ones ; but the male, not having accustomed himself to such company, instead of feeding the nestlings himself, as is usual, carried such food as he collected to a certain spot on the roof, where he left it, and from whence it was borne by his mate to the young. It is still more remarkable that she was perfectly familiar with the men into whose shop she had intruded, and flew in and out of it without fear. If by chance a stranger or any other of the persons employed in the same factory entered the room, she would, if in her nest, instantly quit it, or if absent, would not return. The moment, however, that they were gone she resumed her familiarity."

Another instance of irregularity of situation also relates to this bird. It built a nest close to the rails of a railroad, undisturbed by the thunder of the traffic on the line.

"The tree," says Mr. Waterton, "that noble and gigantic son of earth, is the favourite resort of most birds." It is also the selected home of some who penetrate into its trunk, and there construct a nest defended on every side by living



Nest on a Railroad.

wooden walls. In an ash tree at Walton Hall a nest was found under singular circumstances. On cutting away some decayed wood, most unexpectedly the nest of a titmouse appeared in the centre of the tree. It would seem that a considerable period before a branch had been blown down on one side of the trunk. The wound, consequently, caused the decay of the trunk in that part, and here the bird made its entry, and probably resorted to it every year until the

growing wood at the mouth of the orifice had contracted the entrance, and at last closed it up for ever, leaving the nest hermetically sealed up in the hole of the tree. Whilst two sawyers were at work at a ship-builder's yard in Dundee, cutting up an oak log into planks, they discovered a neatly-built wren's nest, with an egg in it, firmly embedded in the heart of the wood. Considering the age of the tree, it was thought probable that it must have been thus imprisoned for more than fifty years. "The Morning Herald" of June 15, 1825, relates that when two men were sawing a larch tree upon the estate of Lynedoch, they discovered a bird's nest with eggs in the centre of the trunk. It must have remained in that situation for a considerable time, as the aperture by which the parents had obtained access to the nest was entirely closed up by the bark of the tree.

It appears from the observations of various naturalists, that the birds which, like woodpeckers, select the interior of trees for the situation of their nests, must generally fix upon some diseased and softened part, which they perforate by means of their bills. Mr. Audubon says that frequently

a tree will present ten or twelve holes which have been scooped out by these industrious artizans; the birds apparently abandoning some parts which yielded less easily to their efforts than others. Wilson says, "the sagacity of the gold-winged woodpecker in discovering under a sound bark a hollow limb or trunk of a tree, and its perseverance in perforating it for the purpose of incubation, are truly surprising." At this arduous task they ply so intently as to be heard till a very late hour in the evening thumping like carpenters. The last author says, "I have seen an instance where they had dug first five inches straight forward, and then downward more than twice that distance, through a black oak." It does not seem improbable that the birds find out the diseased parts by the difference of sound heard on their being struck. Mr. Gould says that the owlet night-jar, an Australian bird, selects the hollow upper limbs or trunks of trees in the forests of that country for its retreat, and on tapping with a tomahawk at the bottom of the trunk, the bird peeps out at the top as if to inquire who was there! *

* Birds of Australia.

It is a familiar observation, that birds frequently select the dwellings of man for the site of their own, and with him enjoy the protection of the same roof. It may not be so well known that they not unfrequently select the nests of other birds for the same purpose; that is, not to dispute possession of the nest with its rightful owner, but simply to enjoy the shelter and protection it affords to their own constructions. Several of the Australian birds have this habit. There is a little finch belonging to that country which often builds her nest among the large sticks which compose the nests of eagles. Even while the huge birds are employed in the act of incubation, these tiny ones venture close into their presence, and bring their young to maturity under their very eye without the smallest molestation on the part of the latter. Another bird selects the dome-shaped nests of the *pomatorhinus*, and with considerable art and neatness forms a cup-like depression in the top of them, which it occupies as its own nest, and in which its young are hatched and matured. The same fact is related also in reference to the nests of the osprey, the nests of which are often the seat of the nests of a number

of small birds, which are always most magnanimously treated by the great bird, whose protection they have sought. The gossiping pen of Rusticus supplies us with another instance in our own country. "The next object of attention," says this amusing writer, "was a titmouse of the large black-headed kind, swinging himself about like a rope-dancer, and whistling out his sing-song just like a fellow sharpening a saw. To my surprise the gentleman entered an old magpie's nest, to which I had paid frequent friendly visits during the previous spring. He immediately came out again, and jumped about, sharpening his saw as before. One might almost as well handle a hedge-hog as a magpie's nest. In this instance some cuttings of gooseberry bushes, skilfully interwoven into an arch above it, rendered it rather more untempting than usual. I was meditating how to commence the attack, when another tomtit flew out in great choler, and rated at me as though I had robbed her. After a good deal of trouble, during which the slender fir top was swinging about with me in the breeze, I succeeded in obtaining a peep into the nest. There was nest within nest: the cosiest, softest,

warmest little nest, with eight delicately-speckled eggs at the bottom of the magpie's more spacious habitation."*

"Venerable ruins, crumbling under the influence of time and vicissitudes of season, are habitually associated," observes the Prince of Musignano, in his continuation of Wilson's American Ornithology, "with our recollections of the owl. But we are now to make the reader acquainted with an owl which, so far from seeking refuge in the ruined habitations of man, fixes its residence and nest within the earth. It does not appear certain whether this owl, which has been called the burrowing owl, really digs its own dwelling in the earth. In some parts of the world it is said so to do. In the United States it certainly does not, but avails itself of the labours of some of the burrowing animals, which have been either driven out, or have left the neighbourhood for other quarters. The marmot villages in this country are the grand resort of this grovelling bird. These villages are very numerous and variable in their extent, sometimes covering only a few acres, and at others spreading over the surface of the country for miles together. They are composed

* Magazine of Natural History.

of slightly elevated mounds, having the form of a truncated cone about two feet in width at the



Burrowing Owl.

base, and seldom rising as high as eighteen inches above the surface of the soil. The entrance is placed either at the top or on the side, and the whole mound is beaten down externally, especially at the summit, resembling a much-used footpath. From the entrance the passage into the mound descends vertically for one or two feet, and is thence continued obliquely downwards until it

terminates in an apartment, within which the industrious marmot constructs, at the approach of the cold season, the comfortable cell for his winter's sleep. This cell, which is composed of fine dry grass, is globular in form, with an opening at the top, and the whole is so firmly compacted that it might without injury be rolled over the floor. The chamber in which this cell is placed is selected by the owls for their own residence. In all these villages of the marmots the burrowing owls may be seen marching briskly about, and manifesting little timidity. If alarmed they descend into their burrows, and, confiding in the security of their dwellings, abide there until all danger is past. The dwelling soon manifests the absence of its original constructor, becomes channeled by rains, and falls in time to ruin."

Birds that build by the water-side are often apparently careless in the situations they select for their nests, and they do not appear to be endowed with the same degree of constructive skill as many others. There is also less art employed to conceal their nests, because near the water's edge enemies are less prone to be on their pursuit. The common gallinule of America constructs its nest of a quantity of

withered rushes and plants interwoven with more labour than art in a circular form, surrounded by an edge or rim four or five inches high. In Lower Louisiana, Audubon found the nest within five or six feet of the water's edge, among the rankest weeds. In some instances it was placed on a prostrate trunk of a tree over the water, when the materials of which it was composed were less abundant than in other circumstances. He says, "I never saw one floating loose, but have often heard people say they had occasionally seen a nest in that state, although I am not much disposed to give credit to such assertions." A similar statement has, however, been made on credible authority with respect to our English coot, (*fulica atra*). The nests of this bird are large, and, at first sight, apparently clumsy; but on examination are found to be amazingly strong and compactly put together. They are sometimes built on a tuft of rushes, but more commonly among the reeds. Some are supported by those that lie prostrate on the water, whilst others have their foundations at its bottom, and are raised till they become from six to twelve inches above its surface, sometimes in a depth of one and a half or two feet of water. "So firm

are some of them," writes Mr. Hewitson, "that whilst up to the knees in water they afforded me a seat sufficiently strong to support my weight. They are composed of flags and broken reeds, finer towards the inside, and contain from seven to ten eggs, which vary very slightly except in size. That the nest may rise two or three inches with the rising of the water from a flood is quite probable, from the elasticity of the reeds to which it is attached." A coot built her nest in Sir William Middleton's lake at Belsay, Northumberland, among the rushes, which were afterwards loosened by the wind, and, of course, the nest was driven about and floated upon the surface of the water in every direction; notwithstanding which the female continued to sit as usual, and brought up her young upon her movable habitation.

The water-hen, or moor-hen, builds its nest upon the sides of lakes and ponds, and frequently, to its misfortune, close upon the margin of a running stream, or upon an island close to the water. When the level of the water rises the poor bird frequently beholds her nest threatened by the flood; and the rising waters at last too often overwhelm her nest, and sweep its ruins from the spot. A most interesting anecdote is

narrated by Mr. Selby of the proceedings of a pair of these birds, which beheld their dwelling imperilled by the floods. In order to avoid the destruction of their nest and the loss of their eggs, these birds conveyed away their eggs to a place of safety, where they left them, and then, returning to their nest, constructed another storey to it, which raised it above the risk of the flood, and in this ingenious receptacle they then replaced the eggs which they had conveyed away! Sometimes it appears as if they had been taught by bitter experience the dangers of their accustomed situations. Rusticus relates a case apparently of this kind. In one of his ornithological excursions, he paid a visit to a lake stored with water-fowl. "Having pushed off from the shore, and moored the little shallop to some of the osiers which surrounded the island, I began my accustomed examination. The first object that attracted my attention was a lot of dry rushes, flags, reeds, &c., enough to fill a couple of bushel baskets. This mass was lodged about twenty feet from the ground in a spruce fir-tree, and looked for all the world as if it had been pitched there with a hay-fork. I mounted instantly, thinking of herons, eagles, and a variety

of other wonders. Just as my head reached the nest—flap, flap—out came a moor-hen, and, dropping to the water, made off in a direct line along its surface, and was at last lost in the rushes of a distant bank, leaving an evanescent track along the water. The nest contained seven eggs. The situation was an odd one for a moor-hen, but there was a reason for it. The rising of the water in the pond frequently flooded the banks of the island, and, as I had before witnessed, had destroyed several broods by immersion.”

A highly picturesque object on the Thames last summer (1850), was a swan's nest, represented in the next page. The bird was perfectly unconcerned at the constant passage of large and small boats.

The following interesting anecdote is related by Mr. Yarrell, about a swan and her nest. “This swan was eighteen or nineteen years old, had brought up many broods, and was highly valued by the neighbours. She exhibited, some eight or nine years past, one of the most remarkable instances of the powers of instinct that was ever recorded. She was sitting on four or five eggs, and was observed to be very busy in collecting weeds, grasses, &c. to raise her nest; a farming man was ordered to take down half a load of

*Swan's Nest.*

hulm, with which she most industriously raised her nest and the eggs two feet and a half. That

very night there came down a tremendous fall of rain, which flooded all the malt and hops, and did great damage. *Man* made no preparation, the *bird* did. Instinct prevailed over reason: her eggs were above, and only just above, the water."

Not to extend this part of our subject to a greater length, it will be here sufficiently evident that nothing can be more varied than the situation in which the nests of birds are placed. Just as the habits of various kinds of the feathered tribes differ from each other,—as some seek and obtain their food in the depths of the forest, others on the desolate sea-shore,—as some fly with not easily accountable instinct to the society of man, while others timidly shrink from his presence; so the spot where their young are to be brought out will vary almost infinitely. In the sketch here presented, the more interesting and important of the facts connected with the situation of the nests of birds have been detailed; but a short residence in the country, with a mind zealous and earnest in the pursuit of the home marvels of nature, will present the reader with a store of facts upon the same subject, more interesting because more freshly savouring of the indescribable charm of country life.

CHAPTER II.

THE MATERIALS.

THE instinct with which the Creator has endowed birds, in the construction of their nests, is not less manifest in the choice of the materials of their fabric, than in that of the situation in which it is placed. The end in view—namely, the preparation of a suitable cradle for the young, and a commodious structure for the parent in the act of incubation, or hatching—is variously attained, but is always attained, although the materials of the nest differ from each other as widely as possible. In some cases, it appears necessary that the young should be defended from the penetrating blasts of the chilly days of spring ; and this is done by the employment of a material which is as impervious to air as are the walls of a cottage. This is eminently the case in the nest of the song-thrush, which has a mud lining within, surrounded by vegetable materials of various kinds

on the outside. In the case of others, this seems less needful,—we know not why; and the ma-



Nest of the Thrush.

terials will then consist of an open airy basket-work of sticks. Some nests are exposed, it may

be, to the attacks of many foes ; and they must be so constructed as to offer no striking contrast to the surrounding objects. To this end, the materials harmonize with the colour and character of these objects. In the case of others, no enemy appears to be apprehended, and the materials selected are simply those which are most convenient for the purpose the bird has in view. In some cases the architect is compelled to make choice of just such rough materials as the situation it has selected is found capable of affording. In others more favourably circumstanced there is no lack of these things ; and the nest exhibits how carefully and how wisely its ingenious constructor has availed itself of the opportunities placed within its reach. We shall find, as we proceed, that the materials employed are, as from these considerations it seems natural to expect, singularly various ; while sometimes no materials at all are required, no nest is constructed, but the bare egg lies exposed to the winds of heaven upon the naked rock.

It is difficult to proceed systematically in an account of the materials employed in birds'-nests ; but, as far as may be, we shall endeavour so to do. Let us then advert, in the first instance, to those

nests which are constructed out of moistened earth, and the fabrication of which singularly illustrates the ingenuity and skill of the little architect. The swallow is our most familiar example of a mud-building bird. As soon as the situation has been decided on, the birds proceed to collect the materials. In the performance of this duty they may be seen often at the edges of ponds, busy in gathering up small portions of moist earth. Sometimes they may be seen by the margins of puddles, in the road-side, collecting these pellets of earth. They then fly away with them to their selected site, and here proceed to fasten them against the wall. These pellets are bound together (on the same principle as bricklayers employ hair mixed in their mortar) with straws and bents; and the structure is then moulded into a saucer-shaped nest, the interior of which is lined with feathers. The house-martin employs similar materials, and, like the swallow, may often be seen on the ground, in damp places, collecting the mud. "It seems probable," observes Mr. Yarrell, "that the earth is mixed with the saliva of the bird, by which its tenacity is increased." White remarks,—"A martin built its nest against the glass of a

window. It seems to stick firmly, and has no other support." Had the materials in this case been simply moistened with water, no doubt the weight of the nest would have precipitated it to the ground. It has been thought that they select the castings of worms for their nest; but the supposition does not seem borne out by fact. A pleasing account is given by Mr. Couch of the proceedings of these architects. "Their time for working in the erection of these clay tenements is in the early part of the day, so that the mortar may have the benefit of the drying influence of the sun; the afternoon being employed in hunting after food. But in a situation near the sea, which was covered by the tide at their usual time for labour, these birds exercised so much reflection (?) on the natural phenomena of the ebb and flow of the tide, as to employ the morning for collecting food, reserving their labour for the time when, they reasoned, (?) their materials would be accessible to them. The mortar is conveyed in a pellet, in the top of the bill; and they are careful not to hasten the structure too fast, lest its own weight, while loaded with moisture, should bring it to the ground. An instance is remembered, where, from some such

cause of suspicion as to the stability of the edifice, a martin had recourse to the wonderful expedient of working in a straw, as a binding beam along the curve of the structure! The ends were, it seems, secured without difficulty; but the efforts of the little builders to bend down the arch formed by the rising of the middle were in vain; for whenever the pressure was removed, it persisted in maintaining its elasticity. The baffled bird glanced about, as if in contemplation of the difficulty, and seemed ready to receive any suggestion which might be offered, till, tired of watching the invariable result of so many efforts made in vain, the observer walked on. Returning an hour or two afterwards, the little architect was observed to have resorted to the only plan which could be effectual: he had left the ends free, which thus projected a little from the mortar, and the structure was complete at last."

These materials are not without their disadvantages. It has been well remarked, that no bird suffers so frequently from the peculiar construction of its nest, as the house-martin.* The rook will at times have its nest torn from its airy site, or have its

* Knapp: Journal of a Naturalist.

eggs shaken from it by the gales of spring; but the poor martin, which places its earthy nest beneath the eaves of our houses, is more generally injured. In July and August the young are generally brought out; but one rainy day at this period is often attended with fatal consequences to the whole family;—the mud, imbibing moisture from the air, becomes softened to such a degree, that the cement falls, and the nest, having now to support the weight of the young birds, is no longer capable of doing so. Ruin is impending, and the parent birds appear even to be aware of it, for they may be seen hovering with great anxiety about their nests. Suddenly the whole earthen fabric gives way, and all the unfledged young ones are dashed, amid its wreck, to the ground, and killed under the very eyes of their unfortunate parents.

In his magnificent work on the Australian birds, Mr. Gould makes mention of a very singular nest of mud observed by him. The name of its constructor is the Pied Grallina. This curious nest is from five to six inches in breadth, and about three in depth. It is composed of soft mud. It is moulded almost as skilfully as if it had left the

hands of the potter; and from its size, smoothness, and rounded shape, it wears a close resemblance to an earthen vessel. What adds to its singularity is, that it is frequently placed on a bare horizontal branch, conspicuous to every eye. Sometimes the bird selects brown mould for its material; and when this is the case, it works up blades of grass with it, so as to render the mass coherent. It is very probable that a glutinous secretion may be added to the materials; otherwise the tenacity and preservation of the nest, especially in its apparently dangerous position on the bough, cannot be easily accounted for. It is lined with dry grass and feathers. In the collection at the British Museum, a nest of this kind is to be seen.

The next material of the nest to which our attention is called, is one of great singularity. Those of our readers who have enjoyed the opportunity of visiting the Chinese Collection, which used to be exhibited near Hyde Park Corner, in London, will remember the curious objects contained in Case 41. Among other rarities were the singular dwarf trees which these people so highly value; and by their side were two speci-

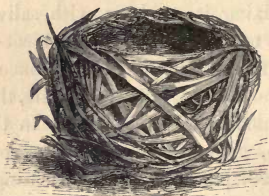
mens of the *edible bird's-nest*. In an unprepared state these nests have a shining look, as if they were made of some dry gelatinous matter. When prepared, the impurities being removed, they resemble still more closely matter of this description. The birds which construct these singular nests are natives of Java.

In the Chinese markets so highly are these nests valued, that they sell, if of the finest quality, at the enormous price of nearly 6*l.* per lb.! They are used in soup, and are considered excellent restoratives. There is a great dispute among writers as to the materials employed in these singular nests. From their external appearance it is extremely difficult even to form a conjecture as to the probable source from whence they are derived. It is now, however, very commonly believed, that these materials are a kind of sea-weed. The birds near the sea-coast appear to use little or no other ingredient in their fabrics; but those which build their nests inland seem to use the sea-weed as a sort of cement to bind other materials together. In the British Museum there are several specimens of these nests. By the side of them are fragments of another, formed

of sticks, and cased with the gelatinous substance within and without. It seems very probable that the bird subjects the sea-weed to some sort of preparation, mixing it, perhaps, with saliva, and so rendering it more adapted to the object they have in view. The caverns in Java produce annually the large amount of 6,810 lbs. of nests, the average value of which is about 25,000*l*. In the Indian Archipelago, generally, this singular property is worth 284,290*l*. per annum,—a surprising evidence of the extraordinary value to which the luxury of man is able to elevate an article otherwise of little value. Doubtless a thousand less costly restoratives exist; but the Chinese love singularity, and are not unwilling to pay for it.

Let us advert now to the materials unquestionably derived from the vegetable kingdom. Perhaps one of the simplest instances of a nest of this kind is that of Savi's warbler. This little bird (*Salicaria luscinoides*) is occasionally found frequenting our marshes, and uttering a singular note, resembling the noise made by a spinning-wheel. Its nest is pretty, but extremely simple. In shape it resembles a cup. It is placed on the ground. The materials of which it is

formed are the narrow leaves of the common reed. These are wound round and interlaced with some

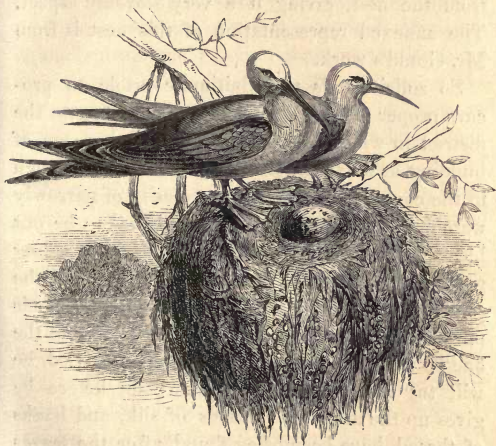


Nest of Sav's Warbler,

degree of art, as is evident from the annexed representation of this structure. They are without any other lining. The dabchick, or little grebe, also makes use of the simplest materials. As soon as the weeds of the waters which these birds frequent are sufficiently luxuriant for the purpose, and in those parts where the bulrush grows tall and waving, they begin to build. Gathering a sufficiency of the aquatic weeds together, they deposit them in a large flat mass, which is raised an inch or two above the water. Weeds form the only materials of this rude and simple nest; and they

are so loosely put together, that, on pressure with the hand, the water rises through their interstices.

The lesser noddy, a bird frequenting the Aus-



Lesser Noddy's Nest.

tralian seas, constructs its nests close together, generally on branches of the mangrove-trees, at no great height from the ground. The nest is as simple as it is possible to be: it is a mass of sea-

weed, loosely thrown across the branches, with scarcely any regard to form or neatness; and in many instances long pieces of sea-weed hang down from the nest, giving it a very slovenly aspect. The annexed representation of this nest is from Mr. Gould's work.

So solicitous is the Baltimore oriole to procure proper materials for his nest, according to the district in which he resides, that in the season of building, as we are informed by Wilson, the women in the country are under the necessity of narrowly watching their thread that may chance to be out bleaching, and the farmer to secure his young grafts, as the oriole, finding the former, and the strings which tie the latter, so well adapted for his purpose, frequently carries off both; or should the one be too heavy, and the other too firmly tied, he will tug at them a considerable time before he gives up the attempt. Skeins of silk, and hanks of thread, have been often found, after the leaves were fallen, hanging round the nest, but so woven up and entangled, as to be irreclaimable. Before the introduction of Europeans, no such material could have been obtained; but, with the sagacity of a good architect, the oriole has improved this

circumstance to his advantage, and the strongest and best materials are uniformly found in those parts by which the whole is supported.

The nest of the Hudson's Bay titmouse presents us with an instance of a nest composed entirely of animal substances. One of these nests was found by Audubon in a hollow tree. It was shaped like a purse, eight inches in depth, two in diameter inside, and its sides were about half an inch thick. It was entirely composed of the finest fur of different quadrupeds, but principally of the great northern hare, so thickly and ingeniously matted together throughout, that it looked as if it had been felted by the hand of man. It was quite elastic throughout, and rather wider below than above.

Into by far the greater number of nests, however, a variety of different materials enter. While the intricate framework is very frequently composed of vegetable materials, the lining is generally derived from the animal kingdom. But no rule can be laid down in this respect which is not subject to an infinite number of exceptions. Our familiar friend the red-breast employs the most odd variety of materials for its little fabric in some circumstances. In an instance mentioned

by Mr. Thompson,* a nest was placed in a carpenter's loft; the foundation consisted of large wood shavings, of which the sides also were formed; the inner parts consisted of moss, beech-leaves, wool, tufts of cow-hair, &c., but the lining was of horse-hair only. The mass of materials was of considerable size, and the architect became well known to the carpenter by making free with his pot of grease. Moss, dead leaves, dried grass, with a lining of hair, or sometimes a few feathers, are the ordinary materials of the robin's nest. Mr. Gosse, in his interesting volume on the birds of Jamaica, gives an account of one of the most simple of these nests of different materials, animal and vegetable, that can be conceived. Observing several small swallows flying about some cocoa-nut palms, attention was drawn more closely to the latter, and near their summits some masses of cotton were seen projecting from some of the upper parts of the tree, which were supposed to be their nests. An opportunity of obtaining some of these nests afterwards presented itself. Their structure was simple, but highly curious. They were placed in the hollow parts of the palms called

* Annals of Natural History.

spathes, in a series of three or four, one above another, and agglutinated together, but with a kind of gallery along the side communicating with each. The materials were feathers and silk-cotton. The most downy feathers were placed within, the cotton formed the external lining, and the whole was closely fitted together and cemented by some slimy fluid, probably saliva. With this they were glued to the spathe so strongly, that, in tearing one out, it brought away part of the integument of the spathe. The walls of these nests, though only a quarter of an inch thick, were fitted so closely as to be almost as tenacious as cloth. Some specimens of recent construction had a singular hairy appearance resembling a doll's wig. In shape they looked like the watch-pockets which are hung at the heads of beds! In height they were about five inches, and in width between three and four.

The nest of the American prairie-warbler exhibits a singular combination of materials in its structure. This little fabric is uncommonly small and delicate. It is attached to three or four blades of tall grass, or hangs pendent between two small sprigs of a slender twig. The external parts are

formed of delicate grey lichens, and other vegetable substances, and also of the skins of black caterpillars! The interior is lined with the finest fibres of dried vines. The following instance, narrated by Audubon, pleasantly exhibits the principle of selection which influences birds in proportion as their nest progresses towards completion.

The architects (warbling fly-catcher) began their work by selecting some slender blades of grass, which they attached to the knots in the branch and to the bark. This formed the scaffolding. They then collected bits of hornet's nests and particles of corn-husks, which were pushed into the interstices of the framework of grass, and secured by silken ties. Slender grass blades were now procured and laid within the frame. After forming a sufficient bed of this material the innermost lining was to be prepared; and now wool and horse-hair were alone employed. After eight days of toil they had completed their nest; and a very warm and pretty structure it now appeared, becoming in due time the home of a happy and thriving family of young ones.*

The American swift, in its method of procuring

* Ornithological Biography.

the materials for its nest, resorts to a singular manœuvre. At the next building time the birds may be seen in great numbers whirling round the tops of some decayed trees, as if in pursuit of insects. They throw their bodies suddenly against a twig, grapple it with their feet, and by an instantaneous jerk snap it off short, and proceed with it to the place intended for the nest. Here the twig is glued and cemented with saliva. The frigate pelican sometimes has been seen to carry off twigs in a similar manner, employing, however, the bill instead of the feet to seize them with. Passing swiftly over the tops of trees, they break off the dry twigs with the utmost ease by a single grasp of this powerful instrument.

It is a beautiful sight to behold several of these birds passing and repassing with the swiftness of thought over the trees whose tops are blasted: their purpose appears as if accomplished by magic. It sometimes happens that the bird accidentally drops a stick while travelling towards its nest, when not unfrequently it instantly plunges downwards after it, and seizes it before it has reached the waves.*

* Audubon : Ornithological Biography.

Sometimes the materials are stolen. When this is the case, the scene is rendered highly amusing. A curious anecdote is related of a thieving gold-crested regulus,* by Mr. Thompson. A friend of the narrator's, while attending to the nest-building of a chaffinch near his window, found that he was not the only spectator,—a regulus at some little distance being recognised as a looker-on. When the chaffinch took flight from the nest, this bird in the most cunning manner stole round to it in an opposite direction, and carried off part of the materials. This evil habit became confirmed, and in at least a dozen instances the bird was seen to be guilty of a similar theft. The industrious chaffinch, however, ultimately discovered the fraud, and caught the thief in the very act! The latter instantly took flight, with the wronged chaffinch in hot pursuit after it. After a long chase, the thief got away, not having been “stopped” by any of the respectable inhabitants of the grove. The lesson, however, proved a salutary one, and the regulus either fell into more regular habits, or else pursued his depredations elsewhere.

The jackdaw is a terrible depredator on occa-

* Annal. Nat. Hist. vol. i. p. 25.

sion; not, however, as it appears, so much from birds as from man himself, as the following sad statement will sufficiently evince. Jackdaws are numerous at Cambridge, and delight in building their nests in the venerable piles of architecture which adorn the town. The botanic garden is unfortunately only too near these structures, as the jackdaws soon discovered. Perceiving in its neatly-arranged beds a number of little wooden labels employed to denote the names of plants, they seem to have considered them a very suitable material for the construction of their nests, being both ready for use and conveniently near home. A large proportion of them were made out of deal laths, being about nine inches long and one inch broad. To these the jackdaws helped themselves freely whenever they could do so without molestation. As the birds were not sufficiently learned to distinguish between such as were written, and such as contained no inscription, the greatest inconvenience arose from their thefts, it having become impossible to distinguish between beds of seed-plants which closely resembled each other. Some of the species could not be ascertained for a year or more; not, in fact, until they were

fully grown and perfected. The depredation continued year by year, and it became almost impossible to prevent it. In the tower of Great St. Mary's church, and in the steeples of other churches, a large number of these labels, with botanical inscriptions, were found. From the shaft of one chimney near the garden no less than eighteen dozen of these labels were taken out and brought to the curator of the garden, who received and counted them! The manner in which the jackdaws drew the labels out of the ground proved the birds' ingenuity, for they would pull them first to one side, then to another, until they were loosened, when, balancing them in their beaks, they would mount aloft with their prize.

The rook furnishes us with another instance of depredation of a kind resembling the first quoted. The birds in early spring are busy in selecting the situations, and in collecting the materials of their nests. The young birds of the previous year must now construct a home for themselves. This they set about at first with all imaginable diligence, and it seems as if the structure would very quickly be completed: twigs, grass, and fibrous roots are brought in abundance. "But," says

Goldsmith, "their alacrity is often too great in the beginning: they soon grow weary of bringing the materials of their nest from distant places, and they very easily perceive that sticks may be provided nearer home; with less honesty, indeed, but some degree of alertness. Away they go, therefore, to pilfer as fast as they can; and whenever they see a nest unguarded, they take care to rob it of the very choicest sticks of which it is composed. But these thefts never go unpunished; and probably upon complaint being made, there is a general punishment inflicted. I have seen eight or ten rooks come upon such occasions, and setting upon the new nest of the young couple, all at once tear it in pieces in a moment." These thievish propensities give rise to much of the clamour heard in March among the rooks; and taught by experience, they are compelled to set a guard over the nest while the mate fetches what may be required to complete the structure. The frigate pelican is mentioned by Audubon as being guilty of similar pilfering habits.

From the sketch here presented, of the materials employed by birds in the construction of their nests, it will be evident that a variety of different

substances, some the most unlikely imaginable, are employed for this purpose. The vegetable, the animal, and even the mineral kingdom all lend some ingredients to the work in hand. It has also been seen that birds make choice of different materials according to the circumstances in which they may be placed. This, and the union in one nest sometimes of one variety of materials, sometimes of another, renders it a difficult, and, for practical purposes, a useless task, to classify nests according to the substances of which they happen to be composed. No such classification will hold good throughout; and it has been only adopted in the present instance merely for the convenience of arranging the parts in order, and with a view to their better recollection. Having marked the situation, and dwelt upon the material, let us now watch our architects in the use of them in the construction of the nest.

CHAPTER III.

CONSTRUCTION OF THE NEST.

“The daisied lea he loves, where tufts of grass
Luxuriant crown the ridge; there, with his mate
He founds their lowly house, of wither'd bents
And coarsest spear-grass; next the inner circle
With finer, and still finer fibres lays,
Rounding it curious with his speckled breast.”

It has been well said,* “A bird’s nest presents a phenomenon nearly as wonderful as the cell of a bee. This object is so familiar to us, that it excites little or no curiosity. But let it be shown to a person capable of reflection, who had never seen such a structure; let him examine the materials of which it is composed, their admirable aptitude for the purpose which it answers, the convenience of its form for the shape and the warmth of its inhabitants, the lightness, the firmness, the neatness with which its materials are twisted and interwoven; and let him be assured

* Quarterly Review, vol. li. p. 219.

that this curious structure was finished in a few weeks by a pair of birds, with no other implements than the bill and the claws,—and he would instantly be filled with profound astonishment. And how would this emotion be heightened, when he learned that the birds began to build it just in time for incubation, that it was the first they had ever made, and that they had therefore no experience of the days or weeks necessary for its completion? If there be no ingenuity, no foresight in the animal, there must be wisdom and contrivance *somewhere*."

And truly the object is one well worthy our attentive contemplation, whether we regard the materials, the implements for its construction, or the difficulty of the task. That the architects of such a structure are taught of God, is evidenced in all these respects. Their constructive skill will be now presented before us in a variety of cases. The ingenuity displayed by the spotted fly-catcher in the building of its home has often been noticed. The materials are moss, roots, stems of grass, hair, and feathers, out of which the birds have to form a warm and comfortable dwelling. It appears that the female is the

builder, while the male fetches materials and food. The latter having collected some of the necessary materials for the foundation of the fabric, the female begins to interweave long stems of grass at one end of the nest, and, traversing its edge, lays in the remainder of the blade as she makes circle after circle. Meanwhile the male is constantly occupied in procuring materials, and in supplying his mate with food. The latter takes infinite pains to arrange all properly; and "she has been seen," says Mr. Yarrell, "going backward round the upper edge of the nest, arranging the materials which formed the inner lining. The labour and art employed in the completion of this carefully formed nest, are only equalled by the patience of its ingenious architect."

The nest of the reed warbler is another very beautiful instance of ingenious, and even scientific construction. The gentleman who first described this beautiful fabric, does so in the following terms. "It is composed externally of dry stalks of grass, lined, for the most part, with the flowery tufts of the common reed, but sometimes with small dead grasses, and a few black horsehairs to cover them. This nest is usually found suspended

or fastened on like a hammock between three or four stalks of reeds, below the panicles of flowers, in such a manner that the stalks run through the sides of the nests at nearly equal distances; or, to speak more properly, the nest is tied on to the reeds with dead grass, and sometimes, as being more eligible when it can be had, even with thread and packthread, emulating the work of a sempstress." The nest, constructed with so much art, is exposed to peculiar perils. It is generally within a foot or two of the water; and the supports are so elastic, that they yield with every passing wind, or with the movements of the water in which they are rooted. There is imminent risk, therefore, of the destruction of this work of art. But by adopting a triangular support, this risk is much lessened; and though the nest has been seen forced almost to the surface of the water by a gust of wind, yet its occupant sat secure, confident in the skill with which her dwelling had been constructed.

A nest equally elegant and difficult of construction, though not the work of a British bird, is formed by the fantail warbler, a native of the south of Europe,* and abundant in the Greek

* Gould.

Islands. This nest, like the last, is generally found in low swampy places, covered with low grasses. This bird, on account of its minute size, is incapable of twining together any stems of the aquatic plants which present a rigid structure; it therefore avails itself of the tall blades and stalks of grass. The bird pierces each blade, and draws the whole together by means of cottony threads, which are secured at each perforation with a knot as ingenious as if it had been the work of a sempstress. Having in this way bound together its scaffolding, it proceeds to construct its nest. This is composed of very fine fibrous materials. Like the last, while the method of its construction admits of a sufficient degree of



Nest of Fantail Warbler.

movement to adapt it to the position in which it is placed, yet it is ingeniously rendered so secure as to run no risk of injury.

The orioles have long been celebrated for the matchless workmanship of their nest. The materials are so united by the bird as to form a strong firm kind of cloth, not unlike the substance of a hat in its raw state, the nest being of the form of a deep pouch, the whole being shaded from the sun and rain by a natural pent-house, or canopy, of leaves. The materials are in some instances tightly sewn through with strong horsehairs; a feat which is surprising, when we remember that the bird must perform it, as ladies do their crochet-work, by thrusting the hair through one hole, and, again inserting the beak, pulling it back through another.*

The celebrated tailor-bird is a beautiful instance of similar ingenuity in the use of its beak. It may be questioned how far all the accounts of this bird's actions recorded in works on natural

* An old lady, to whom one of these beautiful structures was shown, after admiring its texture for some time, inquired in a tone between joke and earnest, whether it might not be possible to teach these birds to darn stockings.

history are rigidly correct. The following extract from Forbes's Oriental Memoirs contains, however, the account of one who professes to have been an eye-witness of the proceedings of the bird. "It first selects a plant with large leaves, and then gathers cotton from the shrub, spins it to a thread by means of its long bill and slender feet, and then, as with a needle, sews the leaves neatly together to conceal its nest. Often have I watched the progress of an industrious pair of tailor-birds in my garden, from their first choice of a plant, until the completion of the nest, and the enlargement of the young." These birds are natives of Hindostan.

Leaving, however, the further illustration of the employment of the beak as a needle, let us advert to its use as a boring tool. Of birds which make this use of their bills, the kingfishers and the woodpeckers present us with the best examples. On some retired bank-side the pair of kingfishers commence their task. Their long and strong bills being set to work, they soon excavate a certain depth into the bank, upon which one of the birds enters it and scratches out the rubbish with its feet, striking meanwhile with its bill, and

so carrying deeper its tunnel. The other bird all the while appears to cheer the labourer, and urge it to continue its exertions, and, when the latter is fatigued, takes its place. Thus, by the co-operation of both, the hole is dug to the astonishing depth of four, five, or even six feet in a horizontal direction! The hole is just large enough to admit the passage of a single bird at a time: at its extremity is an oven-shaped cavity, in which the eggs are deposited. Audubon put the mining powers of this little bird to a severe trial. A small net bag was fastened over the entrance hole, the bird being known to have gone into its nest, but before morning it had made its escape by scratching away the earth under the net. The next time, a stick that filled the entrance was driven into it to the depth of a foot, but again unsuccessfully, for by the next day the bird had worked its way out.

In the case of the woodpeckers, both birds also co-operate in the excavation. The strength of the bill of some species is very great. Audubon says, "I have seen the ivory-billed woodpecker detach pieces of bark seven or eight inches in length at a single blow of its powerful bill; and, by

beginning at the top branch of a dead tree, tear off the bark to an extent of twenty or thirty feet in the course of a few hours." These birds pay great attention to the situation of the tree they propose to excavate, and to the inclination of its trunk, so as to ensure the seclusion of their nest, and to prevent the influx of rain-water. The hole is generally bored horizontally under the junction of a large branch with the trunk, for a few inches, then directly downwards, sometimes even to the depth of three feet. Both birds work hard at this task, one waiting outside to rest, while the other, lost to view, is working away within. By this equal distribution of labour, their task, difficult as it often is, from the nature of the material, is materially lightened and helped forward.

It is interesting to find birds employing the same instrument, the bill, in the manner of a mason's implement. The house martin makes a most ingenious use of this unlikely tool, so to speak, in the construction of its loamy dwelling. Collecting the materials in the manner we have before described, it builds the foundations of its abode while clinging against the perpen-

dicular side of the wall, supporting itself by its claws and feet. In this manner our little plasterer builds a good solid basis upon which to rear the rest of his dwelling. The bird lays on about half an inch of material every day. This is soon accomplished, and is generally done, as has been said, in the early morning; after which the little architect flies off to collect food, or to sport in the sunshiny air. The next morning beholds the labourer at earliest dawn busy at work; before noon the day's work is completed, and the long hours of the afternoon and summer evenings are devoted to amusement. In about ten or twelve days the nest is complete.

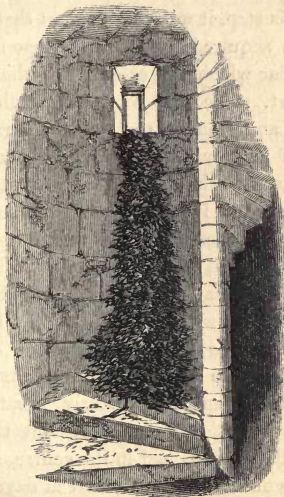
White of Selborne describes the nest with great accuracy, in the following terms:—"The shell or crust of the nest is a sort of rustic-work, full of knobs and protuberances on the outside. Nor is the inside of those that I have examined smoothed with any exactness at all, but is rendered soft and warm, and fit for incubation, by a lining of small straws, grasses, and feathers, and sometimes by a bedding of moss interwoven with wool. They are often capricious in fixing on a nesting place, beginning many edifices, and leaving them

unfinished. These industrious artificers are at their labours in the long days before four in the morning; when they fix their materials, they plaster them on with their chins, moving their heads with a quick vibratory motion." The Rev. Leonard Jenyns has observed the same apparent caprice in the martins, in commencing and leaving unfinished various nests. He says, that "more particularly towards the close of the breeding season, these birds have the habit of flying up against the walls of buildings just below the eaves, and daubing them with mud, apparently without any intention of constructing a nest. These patches of dirt are not applied with any regularity, but may be seen sticking to the brick-work at intervals of two or three inches all along the front of the building. In some states of the weather, particularly our damp cloudy days, especially if also warm, they seem to pursue this singular labour with great assiduity. Occasionally twenty or thirty martins will be busily engaged in this manner from morning till night." Mr. Jenyns thinks it something more than an instance of their "caprice in fixing on a nesting place," alluded to in the former part of this paragraph by White,

and supposes that the birds which thus amuse themselves may be the first broods but lately fledged, whose instinct begins to operate and show itself before it is wanted. The habits of the cliff-swallow of America are in many respects similar to those of the house-martin.

In the majority of instances the bill and the feet are equally necessary to the bird in rearing the fabric in which it is to educate its young. Many proofs of the ingenuity of the architects might be adduced, but perhaps none so striking as the following, which is to be found in Mr. Jesse's pleasant book, "Scenes and Tales of Country Life." In the bell-tower of the beautiful chapel attached to Eton College, a most curious nest was reared by a pair of jackdaws. On attempting to ascend the spiral staircase, any further progress after reaching a certain height was stopped by a sort of pillar of sticks. The origin of this singular pile, which is represented in the adjoining cut, was as follows. On the ledge of one of the narrow apertures for the admission of light, a pair of jackdaws had built their nest. The ledge, however, was so narrow, that the nest had evidently an inclination inwards, and would

probably have fallen down upon the steps below, had not some contrivance for supporting it been



Jackdaw's Nest.

resorted to. This difficulty was obviated by the following ingenious device. As the staircase was a spiral one, the birds began to make a pillar of

sticks on that identical step which alone would give them the best foundation for their intended work. Had they selected either the one above, or the one below this step, it was very evident that they could not have acquired that precise slope or angle for their pillar which was essential to the support of their nest. The step was the eighth below the opening, and from it the pillar was raised to the height of exactly ten feet, and was composed of a strong stack-work of sticks. The nest then rested upon the top of it and was perfectly secure. The labour which these ingenious and industrious birds had bestowed in the collection of so large a mass of sticks must have been enormous. The entrance in the wall by which these materials had all been brought in was very narrow; the difficulty of conveying some of the larger sticks through it must have been consequently great. On examining the sticks, it was evident that each of them had been cracked in the centre, so that they could be doubled up. Seventeen days were occupied by the birds in the performance of their laborious task. Unfortunately, the eager curiosity of a number of persons to see this nest and its supporting pillar ultimately led to its desertion

by the architects, who departed elsewhere to seek a more private retreat.

The nest of the wren, which, though familiar to us, can never be sufficiently admired, is also a structure in the formation of which much patience, ingenuity, and skill are necessary. This structure is of an oval form, arched over at the top, and presents a beautiful specimen of strength, warmth, and neatness. "So compact is it," says Mr. Hewitson, "that one in my collection might be kicked about the floor without much disarranging or disuniting those minute particles of moss of which it was first formed." The materials are frequently just those which happen to be nearest to hand; often the fibres of moss, sometimes hay, sometimes even litter or decayed straw. The architect finds its dwelling in the spring, and both birds commonly assist in the task. Sometimes they adopt a curious division of labour in the task of its construction. "In watching a pair of wrens building their nest in an old road," observes a correspondent of the Magazine of Natural History, "I noticed that one confined itself entirely to the construction of the nest, which it never left for a moment; whilst the other was as incessantly passing and repassing

with materials for the structure. These materials, however, this helper never once attempted to put into their places; they were regularly and always delivered to the grand architect that was employed in constructing the building." The nest is concealed with the greatest art. If during its construction a strange visitor has meddled with it, the last writer states, that he has never known the structure proceeded with, the little architect appearing instantly to recognise the fact of an intruder having been there, by the derangement of the symmetry of its beautifully disposed interior. It is supposed that this may account for the number of unfinished nests which are met with in the fields, and which schoolboys, believing to be the work of the male bird while the female is incubating, call "cocks' nests." The male, it is said, from a desire of occupying himself during this period, will occasionally construct as many as half-a-dozen nests, in the vicinity of the first. As, however, positive evidence of this fact is still wanting, it is more correct to consider, with the majority of naturalists, these "cocks' nests" to be in reality the unfinished structures of a pair of birds. Perhaps the conjecture thrown out by Mr. Jenyns

upon the nest-beginning habits of the martins, may be applicable in some instances to these nests, and they may occasionally, perhaps, be the work of young birds trying their skill at nidification. The former supposition appears the most natural.

It appears to be the general rule for both birds to engage in the construction of the nest. Frequently the female is the artificer, and the male the labourer, who supplies the materials. But cases occur where only one bird performs the task. A singular instance of this kind is narrated at p. 352 of the Zoologist. A male blackbird residing in an orchard appeared to have failed in procuring a mate; or, perhaps, had accidentally lost his partner soon after being mated. Very early in the spring he began building a nest under some long leaves by the side of a fenny place in the orchard. When the nest was finished, it was completely concealed from the sight and protected from rain, by these leaves bending over it; so close, in fact, was one of the leaves, that the bird had to lift it up every time he went in or out. About two weeks after this nest was completed the same bird built another elsewhere in the same orchard. And in this second nest the poor bachelor-bird, or

widower, sat forlorn. When the trees were in full spring-verdure he built a third nest in a thorn bush. During the time he was engaged in these three nests he would continually perch in one of the highest trees in the orchard, and send forth his rich and melodious song, as if to invite a partner to join his family cares, but always without success. The further history of this unfortunate bird we are not informed of; but it is to be hoped that his hard case at last excited the pity of some of his species, and that his neatly constructed home was in due time shared by a mate.

Every reader of this little book will be familiar with the fact that St. Valentine's day is sacred to birds. Chaucer expresses this idea thus:—

“Nature

* * * * *

In voice began to speak and say

Foules, take hede of my sentence, I pray.

* * * * *

Ye know well, how on St. Valentine's day

By my statute and through my governaunce

Ye doe chese your mates, and after fle away.”

The first duty is then the construction of the nest; and in this task birds are in some instances almost as rigidly punctual to the time, as the

legend would have us to believe they are in mating on the fourteenth of February. Rooks are said to be very punctual. Popular superstition declares that the rook regularly lays the *first stick* of its nest on the first day of March; but their punctuality is not quite so precise as this, although it is remarkable enough on the whole. It appears from some careful notes made by Mr. Bree, of the time when these birds begin to build, that from the ninth to the twelfth of March is the more general period at which they do so. In sixteen years they only once began on the third, and in no instance went beyond the twelfth. Records of the commencing of other birds are not sufficiently numerous to afford us information as to their regularity in respect to time, or otherwise.

As, with regard to the collection of materials, we had to narrate the pilfering propensities of birds; so, before closing our chapter upon their general industry in constructing their nests, we ought to mention that there are several more serious robberies on record than those relating to the theft of a few materials. Sometimes the entire structure is appropriated, the

nest is entered, and the bold but lazy invader twitters his triumph in the face of the astonished rightful possessor of the fabric. Authentic anecdotes of this bad conduct are related. The sparrow, bold, impudent, but droll, is the invader in many of these instances. The pendent bed of the martin is often the nest he selects for his own. Mr. W. Thompson very justly says, however, "the nest of the martin is generally tenantless when taken possession of, and the sparrow may have no anticipation of the rightful owner coming across the seas to claim his property."* This bird also occasionally takes possession of the burrows of the sand-martin before the return of this species to the place of its birth, and is to be seen perched at the entrance of its neighbour's burrow, and peering about and chattering with as much confidence as if the domicile were its own by right of descent.

The house-martin, however, sometimes plainly declares its surprise at the invader's intrusion, and its determination, if possible, to eject him. This is difficult, as the mud castle is impregnable on all sides except a small orifice in the most

* Annals of Natural History.

sheltered side; and here nothing is to be seen but the sharp beak of the sparrow, and its determinedly twinkling eyes. The martins besiege the nest with their cries, and are apparently engaged in a war of words with the invader, who shows not the least disposition to come out. Threats and entreaties being found to be in vain, the defrauded pair of birds resolve on seeking further assistance. They fly away, and have been seen in some time after, to return with about twenty of their kindred. With their assistance they proceed to inflict a terrible punishment on the unsuspecting sparrow—which is no less than burial alive. Collecting a sufficient quantity of clay, a number of birds stop up the entrance to the nest, and the following day the pair proceed to construct a new one against its side. This anecdote is a matter of fact. The proprietor of a cottage where such a scene had been enacted had the curiosity to pull down both nests, and in that occupied by the sparrow found its rotten corpse, together with several eggs.*

Another instance, which may be held out as a warning to all sparrow-burglars, is recorded in the

* Mr. W. Thompson: *Annals of Natural History*.

ninth volume of the Magazine of Natural History. A pair of martins had built a nest to the upper cornice of one of the highest houses in Cheltenham. A sparrow, envying them their situation, took possession of the nest, to the great annoyance of the poor martins, who for some time in vain endeavoured to expel the intruder; at length the sparrow got his neck entangled in a straw, and the martins, taking immediate advantage of the circumstance, succeeded in throwing him out of the nest. Not being able to free himself from the straw, the sparrow's efforts to liberate himself only accelerated his fate, and he is now hanging by the neck about a foot below the nest, quite dead—a spectacle which ought to strike wholesome terror into every member of his species in the vicinity. What the sparrow does to martins in England, that the house-wren does in America to woodpeckers.

Occasionally enemies of a different kind invade the nest, and dispute its possession with its lawful owners and architects. A most remarkable contest of this kind is narrated by Mr. Blackwall. For a long series of years a pair of pied fly-catchers had incubated their eggs and nurtured their

young in security in a small aperture near the portico of a house in Denbighshire, undisturbed by the frequent passing and repassing of the inmates. Unfortunately, on the 18th of June, 1843, a swarm of bees discovered the aperture, which then contained a brood of nestlings nearly fledged, and, by buzzing in and out of it, and flying about the entrance in large numbers, seemed determined to dispossess the rightful owners. Whenever the parent birds attempted to approach the spot for the purpose of feeding their young, they were instantly attacked and repelled by the excited bees, from which they took refuge among the branches of an oak growing near, and there manifested their anxiety by notes and actions expressive of extreme uneasiness. After having been severely stung, the nestlings fluttered to the mouth of the aperture, and dropped to the ground, where they all perished, their bodies being much swollen. In the next year the same birds returned, but were again repelled by the bees, and, as if now perceiving that all further attempts were useless, took up their residence at no great distance from the spot where this calamity had taken place the year before.

Sometimes snakes get possession of the nests of birds,* particularly of the woodpecker and the parroquet. Mr. Gosse, speaking of the yellow-bellied parroquet, in the *Birds of Jamaica*, says,—“The precaution of the poor bird in selecting a locality in the trunk of a tree, and her perseverance in burrowing into so solid a structure, are not sufficient to secure her safety or that of her young. The aperture by which she herself enters and departs affords also entrance to a subtle and voracious enemy—the yellow boa. A young bird-nester, having once mounted to plunder the bird’s nest, thrust his arm into the hole, and felt something soft at the bottom, which he guessed might be the callow young. Hesitating, however, to trust it, he thrust in a stick, and discovered, to his discomfiture and terror, an enormous yellow snake, about whose jaws the feathers of the swallowed parroquet were still adhering, while more of her plumage scattered in the nest revealed her unhappy fate. The serpent instantly darted down the tree; and the astonished youth,

* The Frontispiece to Part II. shows the contest between a snake and the Ferruginous Thrush of America, for the possession of the nest.

certainly not less terrified, also descended with the utmost precipitation, and ran as if for life from the scene."

Having now dwelt sufficiently long upon the construction of the nest, we proceed to consider the last subject to which we shall advert in connexion with the nests of birds,—namely, their form and size.

CHAPTER IV.

FORM AND SIZE.

WE are often led to form our idea of the civilization of a tribe of men by the form, size, and architecture of their abodes. The villas of Greece and Rome reveal to us, at a glance, that the nation which could erect structures like them must have been far advanced in the arts and sciences of civilized life. The huts and tents, on the contrary, of savage tribes, but little removed in point of comfort and convenience from dens and caves, show us that the nation dwelling in abodes so rude, so dark, so unhappy, so miserable as these, must be but a wild, uncultivated race. But this does not apply to birds. What bird so sharp and sagacious as the rook, or the jackdaw! yet what nests so rude and inartificial! and how ill they contrast with the beautiful structure of the chaffinch, or of the wren! Neither, indeed, can we always find, as has been before remarked, a cause for the varia-

tions in structure and form which are presented to our notice in various instances. That the form, structure, and size of the nest are admirably adapted to the requirements of the young birds, no one can doubt, who bears in mind the truth that all their actions are regulated by an instinct whose source and author is the all-wise Creator. We are enabled, having watched our architects selecting their situation, collecting their materials, and constructing their beautiful fabric, now to present some highly singular particulars respecting the varied forms assumed by their structures, some of which surpass in ingenuity all the works of man.

The expression, "a bird's nest," conveys a general idea to the mind of the form which this structure commonly assumes, and which has become familiar to us. We imagine it a round, hollow, cup-shaped little fabric, smooth within, and commonly rough on the outside. And such, doubtless, is the form of by far the majority of the nests of birds. But other forms are not unfrequently met with, and of sufficient variety to admit of being classified to a certain extent. Thus there are varieties of the cup-shaped nest, shallowing down to the saucer

nest, and this to the flat nest. In the opposite direction, again, the walls of the nest rise upwards, and form a purse-shaped nest ; and higher still until they, over-arching, meet above, when the nest is called dome-shaped. To one or other of these varieties a large number of nests may be reduced ; and in so doing, it is not of course necessary to regard the materials of which they are composed, the external form alone being taken into account. The manner in which the nest is supported introduces another means of classifying many nests. While some rest on the ground, or on the branches of a tree, where they are supported by the diverging of the boughs, others are suspended by their rims, and some even hang down swinging in the air ; and these last are called "pensile nests." Nests are also frequently classified according to the method of their construction. Some, for instance, are woven, some are felted, some are sewn, some are plastered, some are loosely thrown together. But there is great need of a systematic classification being adopted among ornithologists, who at present have no precise rule for the arrangement of the nests of birds. It is, in fact, a matter of surprise that so little attention should have been

given to these structures, while so large a share has been bestowed upon birds themselves.

Perhaps no structure, in form, or size, or beauty, is so remarkable as the nest of the humming-bird. This exquisite fabric, often seated on the upper side of a horizontal branch, is not more in some instances than an inch in diameter, and as much in depth : yet it is formed with as much or even more art than many of its larger companion-nests. The nest is round and cup-shaped, and might well form the hand-bowl of a fairy. The materials which enter into its composition are lichens, the downy parts of seeds, the fibres of moss, &c., glued by the saliva of the bird. Mr. Gosse saw one of these interesting little beings at work, and watched her fly with a bunch of moss to her nest, and, having seated herself in it, proceed to place the new material, pressing, and arranging, and interweaving, the whole with her beak, while she fashioned the cup-like form of the interior by the pressure of her white breast, moving round as she sat. The occupants of these beautiful structures are as fairy-like in all their movements and in their personal appearance, as in the latter respect are their nests.

What a contrast to this is the vast nest of the sea-eagle, a great mass of sticks and brush-wood, placed on the summit of the loftiest oaks! A friend of Wilson's* ascending a pine tree, on the top of which this huge structure was placed, found it, to his disappointment, empty. It was built of large sticks, some of them several feet in length, within which lay sods of earth, sedge, grass, dry reeds, &c. piled to the height of five or six feet, by more than four in breadth. It was lined with fresh pine-tops, and had little or no concavity. Or, again, that of the double-crested cormorant, which forms its nest of sea-weeds, some sticks, moss, and clods of earth with grass adhering to them, which it piles up into a solid mass, often as high as three feet from the rock, with a diameter of fifteen or eighteen inches at the top, and of two-and-a-half feet at the base. This structure is so strong as to resist the storms of winter, requiring merely a little mending for occupation in another season. Or that of the great white heron, whose nests are often only a few feet from high-water mark, are three feet in diameter, and are loosely composed of sticks. Or the

* American Ornithology.

nest of the great northern diver, with its well-beaten path, or "crawl." This nest, formed of grasses and herbaceous plants, is placed upon a mass of such materials gathered from the surrounding plants. The internal nest is from twelve to fifteen inches in diameter, and is raised to the height of several inches. The nest of the snake-bird, placed on large cypresses overhanging the sides of lagoons, and composed of green branches, moss, and roots, measures two feet in diameter, and has a flattened form. Another large nest is that of the American swan. Captain Lyon describes it as built of moss-peat, nearly six feet long, four and three-quarters wide, and two feet high externally, the cavity being a foot and a-half in diameter.

The following account of the discovery of the nest of the wandering albatross will be read with interest, as exhibiting the situation and the simple form and large size of the nest of this bird * :—
"Yesterday, May 28th, being a fine morning, accompanied by ten of the men, I determined to ascend the mountain. As several parties had before gone up, they had formed a kind of path ;

* Earle's "Narrative of a Nine Months' Residence in the Island of Tristan d'Acunha."

at least we endeavoured to trace the same way, but it required a great deal of nerve to attempt it. The sides of the mountain are nearly perpendicular; but after ascending about 200 feet, it is then entirely covered with wood, which renders the footing much more safe; but in order to get to the wood, the road is so dangerous that it made me almost tremble to think of it. Slippery grey rocks, and many of them unfortunately loose, when we took hold, separated from the mass, and fell with a horrid rumbling noise. Here and there were a few patches of grass, the only thing we could depend upon to assist us in climbing, which must be done with extreme caution, as the least slip or false step would dash one to atoms on the rocks below. By constantly looking upwards, and continuing to haul ourselves up by catching firm hold of the grass, after an hour's painful toil we gained the summit, when we found ourselves on an extended plain of several miles' expanse, which terminates in the peak composed of dark grey lava, bare and frightful to behold. We proceeded towards it, the plain gradually rising, but the walk was most fatiguing over strong rank grass and ferns several feet high. A death-like

stillness prevailed in these high regions, and to my ear our voices had a strange unnatural echo, and I fancied our forms appeared gigantic, whilst the air was piercing cold. The prospect was altogether sublime, and filled the mind with awe. The huge albatross here appeared to dread no interloper or enemy, for their young were on the ground completely uncovered, and the old ones were stalking around them. They lay but one egg on the ground, where they make a kind of nest by scraping the earth around it. The young is entirely white, and covered with a woolly down, which is very beautiful. As we approached, they snapped their beaks with a very quick motion, making a great noise. I again visited the mountain about five months afterwards, when I found the young albatrosses still sitting in their nests, and they had never moved away from them."

This nest consists of a mound of earth, intermingled with withered grass and leaves matted together, eighteen inches in height, six feet in circumference at the base, and upwards of two feet in diameter at the top.

The Arabian Tales repeatedly mention a huge bird which has hitherto been considered as fabu-

lous as the other incidents recorded in those narratives. This bird was called a Roc, and was considered to be a creature capable of winging its way through the air, even with a man on its back ! It would seem that this account, so far as it refers to the size of the bird, can scarcely be deemed fabulous. Among the most ancient records of the Egyptians that have come down to us, there is described a gigantic bird, which is represented by paintings and sculpture on the ancient monuments of that country. Recent researches render it probable that a great bird actually did formerly exist. In New Zealand the fossil bones of an immense bird have recently been discovered. The most remarkable circumstances, however, connected with this subject, are the separate discoveries of Captain Cook, Captain Flinders, and Mr. Burton, of the most enormous nests yet found in the kingdom of birds. Captain Cook says: "Upon this island we saw an incredible number of birds, chiefly sea-fowl: we found also the nest of an eagle with young ones, which we killed, and the nest of some other bird, we knew not what, of a most enormous size. It was built with sticks upon the ground, and was no less than

six-and-twenty feet in circumference, and two feet eight inches high!" The island was Eagle Island on the east coast of New South Wales. On the south coast of the same country, Captain Flinders, in 1802, found two nests of extraordinary magnitude. They were built upon the ground, from which they rose about two feet, and were of vast circumference and great interior capacity. The branches of trees and other matter of which each nest was composed were sufficient to have filled a small cart.

The most surprising account, however, is that of Mr. James Burton. Between the years 1821 and 1823, Mr. Burton discovered on the west coast, or Egyptian side of the Red Sea, opposite the peninsula of Mount Sinai, at a place called Gebel Ezzeit, three colossal nests within the space of one mile. These nests were not in an equal state of preservation; but, from one more perfect than the others, he judged them to be about fifteen feet in height, or about that of a camel and its rider. These nests were composed of a mass of heterogeneous materials, piled up in the form of a cone, and sufficiently well put together to insure adequate solidity. The diameter of the cone, at

its base, was estimated as nearly equal to its height; and the apex, which terminated in a slight concavity, measured about two feet six inches, or three feet, in diameter. The materials of which the great mass was composed were sticks and weeds, fragments of rock, and the bones of fish. But in one, strange to relate, was found the thorax of a man, a silver watch made by George Prior, a London watchmaker of the last century, celebrated throughout the East; and in the nest, or basin at the apex of the cone, were some pieces of woollen cloth, and an old shoe. That these nests had been but recently constructed was sufficiently evident from the shoe and watch of the shipwrecked pilgrim, whose tattered clothes and whitened bones were found at no great distance. From the accounts of the Arabs, it was presumed that these nests had been occupied by remarkably large birds of the stork tribe, which had deserted the coast previous to the traveller's visit.

Whether these nests, constructed so differently, and in such remote parts of the world, are to be considered the work of the same species of bird, is more than questionable. In all probability the species are distinct. It may also be doubted

whether the size of the nest supplies us with any means of estimating that of the bird. Mr. H. Strickland, in reply to Mr. Bonomi's paper on this subject in the Report of the fifteenth meeting of the British Association, mentions that the Australian *Megapodius*, a bird not larger than a fowl, constructs a nest of enormous proportions.*

Let us advert, however, to those exceptions to the ordinary form and appearance of the nest, which scarcely admit of any classification, and are to be regarded almost as forming a distinct class of nests, which might be called "nests of exceptional form." Since, however, in every instance the main end in view is the hatching of the eggs, and the rearing of the young birds, the general character of a nest is not lost, although its shape is altered, and often to a singular extent. The fairy martin of Australia constructs a singular nest, which deserves to be included under this head. It selects the hollows of decayed trees for the site of its nests. These are of the shape of an inverted bottle, with a rather long neck, which forms the entrance to the nest. They are always found in the vicinity of water, as such a situation the more readily

* Athenæum, No. 922.

supplies them with the materials of which they form their nests. During the construction of

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Nests of Fairy Martin.

these nests a curious sight presents itself. One

bird is the architect, and is assisted by six or seven labourers. The latter are despatched to the river side to fetch mud, whilst the former places itself inside the cavity already commenced, and, with the material supplied by the industrious labourers, adds to the nest from within. This continues until the nest is finished. When complete, it is of a rounded form, six or seven inches in diameter, the nest being eight or nine inches in length. These nests are often found in clusters of thirty or forty together.*

The rock-warbler, found in the same country, constructs a nest scarcely less remarkable. The most romantic spots are selected by this bird for the locality of its nests. Along water-courses, on the precipitous sides of rocky gullies, in the hollows of precipices whose feet are bathed by a tumultuous mountain river, the nests are found. In caverns in such spots as these the traveller beholds the extraordinary sight of clusters of bottle-shaped masses of clay hanging by a narrow neck from the roof. It appears extraordinary how the weight of the nest can be safely supported by so small an attachment ; and the nests altogether

* Gould : Birds of Australia.



Nests of Rock-Warbler.

present us with an extraordinary specimen of bird-architecture. The entrance to these nests is at the bottom.

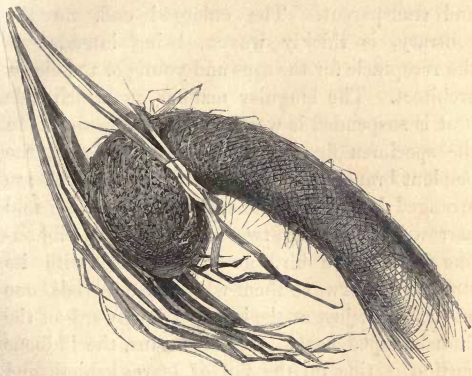
To select another example of a singularly formed nest from the ornithology of this newly explored region, perhaps the most beautiful nest of all is that of the white-shafted fantail. Pendent on the branches of a shrub, which overhang some mountain rivulet, this beautiful fabric is found. In shape it resembles a wine-glass, without the foot. A less elegant comparison would be, to say that it is somewhat like an inverted extinguisher; but this, considering the beauty of its form, would scarcely be just. The nest is composed of portions of the inner bark of the eucalyptus; it is lined with the downy portions of the tree-fern, intermingled with stalks of moss. Externally, webs of spiders enter largely into its construction, matting it together, and attaching it to the branch from which it is suspended. The long part, which hangs downwards, seems to be intended to preserve the balance of the fabric, and to render it less liable to be overturned by the wind.*

* Gould.

Several of the pendent nests present a highly singular appearance. The penduline tit, a bird inhabiting the south of Europe, forms a beautiful structure of this kind. In shape it resembles a flask; but it has a pretty entrance at the side; and its structure is highly ingenious. Out of the soft down of the willow and poplar trees, this artificer, with astonishing skill, weaves its beautiful nest. It is suspended at the end of the branch of a drooping willow, and generally closely overhangs the water. The swallow dicœum of Australia forms a purse-like nest of almost equal beauty, and of the snowiest white, out of the cottony substance of the seeds of plants. The appearance of the bird seated in this pretty nest, and peeping forth out of the opening at the side, is beautifully represented in Mr. Gould's splendid work.

If the reader will take the trouble to examine one of the cases in the Zoological Gallery at the British Museum, he will there discover some of the most extraordinary specimens of bird-architecture in the annals of ornithology. One of these might be called the retort-nest. The shape of this chemical implement is doubtless familiar to every one: it consists of a pear-shaped enlarge-

ment at one end, tapering off into a long descending neck. In order, however, to afford an idea of the



remarkable coincidence in form between these two objects, the bird's nest and the chemist's instrument, the one of glass, the work of man, should be contrasted with the other of grass, the work of a bird. The nest in every respect resembles the retort. It is interwoven with consummate skill. Externally the surface is quite smooth and even,

scarcely a fibre of the grass or hay, of which it is composed, projecting. The neck portion is thinner than the bulbous part, its texture being more open and transparent. The enlarged end, on the contrary, is thickly woven, being intended as the receptacle for the eggs and young of the clever architect. The singular manner in which this nest is suspended is worthy of all admiration. In the specimen figured, the bird had selected the pendent branch of a tree, the leaves of which are arranged in a fan-like manner, and are long and narrow.* Selecting two of these long, ribbon-like leaves, the bird as it proceeded with its structure interwove them with the materials, one on each side, just at the bending downwards of the funnel-shaped neck. By this means, the bulbous portion resting on the fan of leaves behind, and the nest slung to the branch by the employment of its leaves, it is most securely hung. So ingeniously has this been effected, in fact, that to any one who did not closely examine the fabric, it would appear that it had been hung in this way for the simple purpose of exhibition.

By the side of this wonderful structure is another

* The tree is probably one of the palm family.

more complicated—the nest of the stocking bird of India. This is a highly curious structure. It is a flattened nest, closely interwoven of the fibres of grass; the centre is occupied by several apartments, and at the extremity are the entrances to the nest. Without seeing a section of this nest, it is difficult to form an idea of its actual construction. It appears to be rather complicated in its internal arrangements. Externally, it is smooth in structure, and interwoven with consummate skill, scarcely a loose end appearing.

These nests of both kinds are, in all probability, constructed by the bottle-nested sparrows; and in one which is only half-completed, the head and yellow breast of this ingenious bird appears. They are common in most parts of Hindostan; and it is not improbable that there are two or three species, each constructing a somewhat similar nest. One species probably constructs the retort-like nests, another the stocking-like. The birds associate in large communities in the groves, to which their animated sounds and brilliant plumage communicate a peculiar charm. In a recent journey from Mokhá on the Red Sea, Mr. Cruttenden says:—"We have observed many large trees,

one in particular, of a spongy nature, the stem about two feet six inches in diameter, and the leaves very large and of a leathery texture. It is called by the natives the 'tolak tree,' and is generally covered with the nests of the 'baia,' a small kind of sparrow. I have seen upwards of 300 nests upon one tree. They are of a pear-shape, having a long funnel-like aperture at the base, and the interior divided into two compartments, one for the male, and the other for the female and her progeny.* Other authors mention the division of some of these nests into compartments, in one of which the female sits and performs the task of incubation, and in the other the male, who cheers her by an occasional chirp while occupied with her maternal duties. It would appear that the intention of these singularly formed nests is to exclude enemies; and, certainly, the snake, or squirrel, which would attempt the hazardous task of making an entrance into the retort-shaped nest figured on a former page, would run a considerable risk of dropping to the ground and being destroyed by the fall.

In his researches into the ornithology of Austr-

* Journal of the Royal Geographical Society.

lia, Mr. Gould met with a singular nest constructed by an *acanthiza*. The materials employed are leaves, grass, and wool. The nest has a curious resemblance to the figure of eight in form, and is in fact a double nest. The lower and larger part is the real nest, in which the female sits and hatches her eggs; but above it is a second and smaller nest, not intended for the purpose of incubation. The object for which this second nest is built appears probably, according to Mr. Gould, in order to furnish the male bird with a comfortable couch on which he can sit, and relieve the loneliness of the female during her maternal occupations. A little bird found in Southern Africa constructs a nest on the side of which a sort of pouch or watch-pocket is placed, which was long considered to be intended for a similar purpose. It appears more probable, however, that this addition to the nest is intended simply as a sort of perch for the birds when alighting.

Sometimes it appears that the instinct of birds leads them to make additions to their nest, some of which are constant, while others are only occasional. A very ingenious modification of this kind is narrated by Mr. Jesse. The nest was one

formed by the long-tailed titmouse, and so artfully placed on the branch of an elm, and so closely resembling the knot of a tree in external appearance, that it was extremely difficult of detection. This nest had a feather fixed so as to overhang the entrance, forming a sort of valve, which was pushed in or out as the birds left the nest or came into it. Mr. Jesse considered it to have been placed there in order to act as a little door, and so to preserve the warmth of the nest, particularly as it happened to be extremely cold weather at the time the birds were laying their eggs. A correspondent of the Zoologist has remarked the same interesting fact. The nest seemed to be but just finished, and was empty. It was of an oval shape. There was a long entrance to the nest proper, which was slightly arched, so that the interior of the domicile was thus protected from wind and rain. But there was a still more curious contrivance, by which the nest was guarded from the intrusion of unwelcome visitors. A strong feather was fastened to the nest by hairs woven around it and through the moss and lichens. It was so placed, that its top hung over the hole. It bent upwards with the slightest pressure, and imme-

diately resumed its position when the pressure was removed. The bird was once seen flying out in great haste, but its exit was not in the least incommoded by the feather.

The nut-hatch has also recourse to an ingenious contrivance, which renders its nest more comfortable. The bird is sure to select the deserted habitation of some wood-pecker. But the entrance to this wooden abode being larger than the nut-hatch considers convenient, it proceeds to contract it by plastering round the hole, until it has just left sufficient room for it to pass in and out. The nest is formed of dead leaves. If the barrier is accidentally destroyed, the bird again rears it up. It has been thought that the intention of this barrier was to prevent the young from tumbling out of the nest; just as we put iron rails before our nursery windows, or as we may have often seen the poor put up a little gate at the entrance of their houses. Probably, however, the intention in view is simply to render the nest more warm and comfortable, by diminishing the aperture for the admission of air.

Before concluding these chapters on the situation, materials, construction, and form and size of

the nest, it is necessary to caution the reader against the supposition that too much importance is in every instance to be attached to these particulars or to any one of them. While, for example, it would be easy in many instances for the naturalist to decide upon the class to which the bird belonged, simply upon looking at its nest, yet, on the other hand, he might fall into serious error if he were to assign with confidence a nest of one form or class of materials to one species, and another slightly differing from it to another species. The following remarks of Audubon appear appropriately to close this part of our Life of a Bird. "From the above facts, and many equally curious which I have mentioned, respecting the variations exhibited by birds in the manner of forming their nests, as well as in their size, materials, and situation, it will be seen that differences of this kind are not of so much importance as has hitherto been supposed in establishing distinctions between species supposed by some to be different, and by others identical. To give you some definite idea of what I would here impress upon your mind, I need only say that I have seen nests of the barn or chimney-swallow placed within buildings,

under cattle-sheds, against the sides of walls, and in chimneys: that while some were not more than three inches deep, others measured nearly nine: while in some there was scarcely any grass, in others it formed half of their nests. I have observed the same nests of the cliff-swallow in which the eggs had been deposited before the pendent neck was added, and which remained so until the birds had reared their brood, amidst other nests furnished with a neck, which was much larger in some than in others. From this I have inferred that nests are formed more or less completely, in many instances, in accordance with the necessity under which the bird may be of depositing its eggs." *

Accident often determines the form, the situation, and the materials of the nest; and with the variation in each, the art of its construction varies also. Yet in many instances we become witnesses of the same astonishing skill in the employment of the materials, in the adaptation of the nest to the situation or to the circumstances under which it happens to be constructed. It has been well said,—“The nest of a bird is one of those daily

* Ornithological Biography.

miracles, that, from its familiarity, is passed over without regard." And such in reality it is, when we compare the apparent feebleness and imperfection of the instrument with the exquisite workmanship of the structure. Yet while we look at these beautiful fabrics, and admire the ingenuity of their make, and the patience of the artificer, let us not forget to look to a higher cause than the poor bird,—to Him whose attributes of wisdom and love shine in the humblest as well as in the most exalted portions of his creation.



An Enemy in the Nest.

PART II.—THE EGG.

CHAPTER I.

ITS DEPOSITION.

THE first and earliest duty of a bird is completed when its nest is finished. Provided with a home of the most comfortable construction, suited in every respect to the rearing of their young, the deposition of the eggs now becomes of the most pressing importance, and it takes place in a short time, generally a day or two after the nest is completed. The object of this short delay is stated to be to give firmness to the yet damp materials, and to allow them time to dry. The Rev. L. Jenyns says:—"I observe that birds sometimes begin the shell of their nest, or the outer part of the fabric formed of the coarser materials, before it is wanted, and let it remain in this state for some days, and then finish it on a

sudden. In other cases I have known the nest entirely completed, and afterwards a fortnight or more elapse before laying commenced. This last circumstance I have observed occasionally in the chaffinch, and had been led to suppose in such instances that the nest from some cause had been deserted. I passed it day after day, and found it exactly in the same state, without any eggs in it. But it proved in the end to be only a delay, from the circumstance of the nest not being needed sooner. After an interval of longer or shorter duration, the eggs were duly laid and the brood reared. I have noticed the same habit in the tree-creeper." It will be found interesting for us to devote the present chapter to a sketch of the circumstances which in various cases accompany this action, which is the introduction of a new being into the kingdom of terrestrial life. As may well be imagined, it is a time of anxiety to the birds, who have now to guard not merely their home, but their hopes of a future family. Perhaps no instance of this anxiety on the part of the parent birds has been told in a more lively manner than that of the Canada goose by Audubon. No sooner has the goose laid her first egg, than her bold mate stands almost erect

by her side, watching even the rumbling sound of the breeze. The least noise brings from him a sound of anger. Should he spy a racoon making its way among the grass, he walks up to him undauntedly, hurls a vigorous stroke at him, and drives him instantly away. It may even be doubted whether man himself, if unarmed, would come off unscathed in such an encounter. The brave mate does more; for if imminent danger excite him, he urges his partner to fly off, and, determined to do battle to the last, resolutely remains near the nest until he is assured of her safety, when, aware that resistance would now be only fool-hardiness, he also betakes himself to flight, mocking as it were by his notes his disappointed enemy.

Yet frequently less of this disposition is manifested, the bird simply flying from a superior foe. This is strikingly manifested in the guillemot. Mr. Hewitson has given a striking description of the haunts of this bird. At the Fern Islands they occupy a rock, or stack, as such rocks are very appropriately called, which stands apart from the islands, surrounded by the sea; and the eggs cover it so completely, that at a short distance they have

the appearance of a stratum of stone. The eggs are so close together, that it is difficult to move amongst them; and the surface of the rock being whitened over by the excrement of the birds, the blue eggs especially have a peculiarly beautiful appearance. At a short distance is a low, flat rock, which the cormorants are in the habit of resorting to; but though the situation is altogether different from that usually selected by the guillemots, they occasionally lay a few eggs among the thickest ranks of the cormorants, having a singularly ludicrous appearance amidst their taller neighbours, as they sit bolt upright upon their lofty nests.

The eggs of the guillemot are placed upon the bare rock without any nest, and, indeed, without anything to prevent their being swept into the sea by the stormy winds which rage around these islands. The ledges on which they are placed by these foolish birds are often so narrow, that the young ones, when hatched, can scarcely fail of dropping down and being dashed to pieces on the sharp rocks, or drowned in the foaming waters below. When the guillemot has deposited its egg, which is very large, it is often left exposed to all

the inclemencies of the skies while the bird is in search of its food. When disturbed by the foot of man even penetrating its wild and solitary abode, the guillemot makes no attempt at resistance, but takes wing instantly, and often sweeps its egg over the ledge, to be broken into a thousand fragments in falling.

Mr. Waterton, determined to obtain the evidence of an eyewitness as to the habits and haunts of this bird, resolved on paying them a visit in company with the eggers of Flamborough Cliffs.

The eggs of the guillemot and razor-bills form a considerable article of traffic from old May-day till about the middle of June. The usual process of seeking for them is generally carried on by three men; though two will do, in case of necessity.



Guillemot and Young Bird.

Having provided themselves with two ropes of sufficient length and strength, they drive an iron bar into the ground, about six inches deep, on the table-land at the top of the precipice. To this bar is fastened the thickest of the two ropes, which is then thrown down the rocks. He who is to descend now puts his legs through a pair of hempen braces, which meet round his middle and form a waistband. At each end of this waistband is a loop-hole, through which they reeve the smaller rope. A man now holds the rope firmly in his hand, and gradually lowers his comrade down the precipice. While he is descending he has hold of the other rope, which was fastened to the iron bar, and with this assistance he passes from ledge to ledge, and from rock to rock, picking up the eggs of the guillemot, and putting them into two bags which he had slung across his shoulder ere he commenced his arduous undertaking. When he has filled these bags with eggs, he jerks the rope, and the motion informs his friend at the top that it is now time to draw him up. On coming up again to the place from whence he first set out, all the eggs are taken from the bags and put into a large basket, prior to their being packed in hampers and

carried off in a cart by wholesale dealers, who purchase them from the climbers at sixpence a score. They are retailed in the neighbourhood at a halfpenny a-piece.

The rocks are searched for eggs every third day, provided the weather be fair. This undertaking is attended with considerable risk; and it requires much address on the part of the descending climber to save himself from being hit by the fragments of the rock which are broken off by the rope coming in contact with them. The danger is avoided by moving sideways when the stone is falling, and by taking care as he goes down to clear away with his foot any portion of the rock which seems ready to fall. "As I was lowered down," says Mr. Waterton, "the grandeur and sublimity of the scene beggared all description, and amply repaid any little unpleasant sensations which arose on the score of danger. The sea was roaring at the base of this stupendous wall of rock; thousands and tens of thousands of wild-fowl were in an instant on the wing; the kittiwakes and jackdaws rose in circling flight; while most of the guillemots, razor-bills, and gruffins, left the ledges of the rocks in a straight and downward line, with a peculiar quick

motion of the pinions, till they plunged into the ocean. The nests of the kittiwakes were close to



Collection of Eggs.

each other on every part of the rock which was capable of holding them; and they were so numerous, as totally to defy any attempt to count them. On the bare and level ledge of the rocks, often not more than six inches wide, lay the eggs of the guillemots: some were placed parallel with the range of the shelf, others nearly so, and others with their blunt and sharp ends indiscriminately pointing to the sea. By no glutinous matter, nor any foreign body whatever, were they affixed to the rock; here they lay, and unattached,

as in the palm of your outstretched hand. You

might see nine or ten, or sometimes twelve old guillemots in a line, so near to each other that their wings seemed to touch those of their neighbours; and when they flew off at your approach, you would see as many eggs as you had counted birds sitting on the ledge.”*

While the guillemot behaves in this apparently foolish way, and exposes its eggs to every storm of heaven, and to the gaze of every intruder, the conduct of other birds is far different. Repeated instances have come before us of the art with which birds construct their nest, so that in general it does not obtrude upon notice. Resting secure in its entire resemblance to the surrounding materials, the wren will quit her beautiful nest without a fear that during her absence any invader will have disturbed the security of her dwelling. Such also is the behaviour of the majority of birds which, until the time of incubation arrives, make frequent excursions to and from their nests. In committing their eggs thus to the mercies of events, providing first for the careful concealment of their place of deposit, birds are generally fully justified by the rarity with

* Magazine of Natural History.

which the nest is discovered, or by the difficulty of its access if discernible. The guillemot even is justified to a certain extent by the hazard any enemy to its domestic security would incur in the invasion of its nest.

In strong contrast with the apparent negligence of this bird and of several others, is the sedulous care with which some birds cover over their nests and eggs. The eider-duck lays a soft, downy bed of feathers from her own breast upon her eggs, during the time of their deposition. The little grebe, or dabchick, an aquatic bird, common upon ponds and lakes in Great Britain, is endowed with this peculiar propensity; and other aquatic birds have it also. It has been said that the birds cover their eggs in order to keep them warm; but experience does not justify this conclusion. Mr. Waterton, when out in a boat on the lake, surrounding Walton Hall, found one of the nests of a water-hen at the root of a willow, containing seven eggs. The bird had made its escape. On returning the next day, he observed that she had collected a considerable quantity of grass and weeds, and that she had put them all round the nest. On a dry island in the same piece of water,

this gentleman found a little structure, about a foot square, built of brick and mortar, and intended as the dwelling of a duck. It was, however, taken possession of by a water-hen, who, whenever she absented herself from her eggs, covered them carefully over with the hay. A wild duck built her nest on a ruin, in the thick ivy clustering over its top; and she likewise never voluntarily left her nest without concealing it with such materials as lay around.

The dabchick covers its nest with aquatic plants of various kinds, often collected from those lying just around her; rushes and the water crow-foot are frequently employed for this purpose. A correspondent of the *Zoologist* says that he has seen the eggs covered with the latter plant under circumstances when it was evident that the bird must have been at some pains to procure it; none, in fact, was growing where the nest was built, or nearer than an adjacent pond, to obtain it from which the bird must have been at the pains of coming over some dry land. He observes, in addition, that, from the quantity of this material used for a covering, and the extreme rarity of ever finding a full complement of eggs without it, it appears obvious that

it is not hastily placed on when quitting the nest. "It must be a work of time," he continues, "to do it; and the covering is allowed to remain, the bird performing her duties of incubation upon the top of it,—a situation I have sometimes surprised them in,—when plump! in a second, they go into the water, and are seen no more, leaving behind them no more appearance of a nest than a lump of weeds. Upon these occasions I have often found both the eggs and the coverin quite warm, the former far advanced toward hatching." Another writer on the habits of the same bird states, that he never saw a nest not deserted left uncovered; and that the covering almost invariably consists of freshly-gathered weeds. He had often seen the parent bird pecking away right and left, and then slip quietly off the nest as he drew near.

The object which birds have in view whenever they adopt this manœuvre is not certainly in all cases the same. It appears as if, in some instances, the intention is to preserve the temperature of the eggs, and for this purpose the materials used appear well adapted.

It has been suggested, with reference to the dabchick, that, in addition to motives of conceal-

ment, the covering of her eggs may possibly answer another purpose. The rearers of these birds state, that unless the birds have free access to water during the period when they are sitting upon their eggs, and so can return at intervals with moistened plumage to their nests, the young chicks find it impossible to break their shelly enclosure, and in consequence, as it is said, perish, immured alive. The rearers of the birds are therefore in the habit of sprinkling the eggs with tepid water, as a substitute for the moisture from the mother. The covering of moist weeds would of course prevent evaporation from the eggs, and would continually keep the shells in a damp condition. This conjecture appears scarcely credible.

The conduct of the clapper-rail of America, during the deposition of its eggs, deserves our notice. This bird is extremely abundant along the salt marshes and reedy islands of South Carolina, Georgia, and the mouths of the Mississippi. It makes the marshes resound with its loud and harsh cackling, and toward the end of May commences depositing its eggs and building its nest at the same time. The first egg is dropped in a

slight cavity, lined with a little grass pulled for the purpose. Another egg is laid; the grass is again plucked, and the nest is increased in height. Other marsh plants are also employed; and the structure is fastened in the midst of the thickest tufts, above high-water mark. As the number of eggs increases, the height of the nest increases also, until the full complement of eggs,—ten,—has been deposited. The nest is now raised to the height of twelve inches, or more, to secure it from the rising tides; and over it the long grass is skilfully arched and knit at the top, so as to conceal it from view. “But this very circumstance,” observes Wilson, “enables the experienced egg-hunter to distinguish the spot at the distance of thirty or forty yards, though imperceptible to a common eye.” During this time the males stand erect, and cry aloud at the least sound they hear, guarding their mates and their nests with exemplary devotedness. So deep is the nest, that the eggs in it look as if they were at the bottom of a deep funnel. The attachment of the birds to their nest and eggs is very strong; and the poor birds are exposed to many accidents fatal in their consequences.

That such an action as the removal of the egg after its deposition from one place to another, with a view to avoid danger, is not impossible, may be gathered from the fact related by Mr. Selby of a pair of water-hens removing their eggs in time of danger.

Mr. Hewitson makes a similar statement with regard to the dunlin. This bird can scarcely be considered to make a nest: for the most part it is merely a round cavity in the grass or moss amongst which it is to lay its eggs; sometimes pieces of heath and a little dry grass are added, but this is not often. "I once found the nest of one of this species," says the above-mentioned author, "upon one of the unfrequented moors of Shetland; and not then well knowing the eggs, I left them till I could return with my gun to secure one of the birds. I did return a few hours afterwards, but the eggs were gone; and though I have no evidence to prove it, I have myself no doubt that the birds had removed them to a place of safety." It was at least much more probable than that human means had done so in a district scarcely ever trodden. As these eggs taper almost as much as a peg-top, the idea of the difficulty of this action may be

conceived, if it were really performed by the bird, which is by no means improbable.

Some birds, not willing to give themselves the trouble of constructing a nest, determine to select that of others more industrious than themselves. This, it may be said, is bad enough; but what we have next to mention respecting them is even worse; for these birds are guilty of depositing their eggs in the nests of others, and of for ever afterwards relinquishing the care of them. There is even a worse feature in this transaction than either of these, and that is, that very commonly the eggs of the unfortunate bird upon whom this outrage is committed are destroyed and thrust out of the nest by the young bird hatched from the intruder's egg, and are often to be seen, a spectacle of ruin and desolation, at the foot of the tree.

The cuckoo has long laboured under this imputation, and with only too much justice. But it has also been accused of other crimes. Thus it is a complaint put by a poet in the mouth of a bird, that while it sings

"With harmless true intent,
The cuckoo sucks mine eggs with foul deceit :"

an action of which the bird has been found guilty, so far as the destruction of the eggs is concerned, by several careful observers. Another rhyme about the cuckoo informs us of the precise object which the bird has in sucking little birds' eggs; namely, to "make her voice clear." It should be observed, however, that the male bird alone is the singer.

"The cuckoo's a fine bird,
She sings as she flies;
She brings us good tidings,
She tells us no lies.
She sucks little birds' eggs
To make her voice clear,
And when she sings, "Cuckoo,"
The summer is near."

The young bird has been arraigned of devouring its foster mother, and also its foster brethren and sisters, should any have escaped its former destructive propensities. Could these crimes be proved, instead of calling the bird

"The merry cuckoo, messenger of spring,"

we should be justified in denouncing it as the murderous cuckoo, and as guilty of the blackest ingratitude. Although much obscured by fable, the cuckoo's history is now becoming more satis-

factorily stated; and to the real facts ascertained on this subject our attention may well be claimed for their singularity and interest.

It is not easy to explain the cause, but it is an ascertained fact, that the cuckoo builds no nest of her own. Statements have been repeatedly made, in which it would appear that the nest of this bird had been actually discovered; but all such accounts fall to the ground when examined with care. Other birds, not unlike the cuckoo in their appearance, have been mistaken for it, or insufficient evidence has been accepted. All naturalists appear now agreed as to the fact that this bird has not the nest-building faculty. It has therefore to rely upon the industry of another to provide a suitable home for its young; and were we to be the apologists of this bird, we might even maintain that, conscious of its own inability to supply its wants, or to undertake the task of its rearing and education, the cuckoo seeks to place the germ of her future offspring where she knows it will be safe, and where that will be done for it which she is unable to perform. Be this as it may, the bird selects a nest already formed for the deposition of her egg, and here, either with

the heedlessness of a careless mother, or with the foresight of a prudent parent, she leaves it.

The unfortunate birds whose nests are selected for this outrage are by no means those of one species. The ancients used to imagine that the dove was nurse to the cuckoo; this is an error. The list given by Mr. Yarrell of birds in whose nests the eggs have been found is as follows: the hedge accentor, the robin, the redstart, white-throat, willow-warbler, pied wagtail, meadow-pipit, rock pipit, skylark, yellow bunting, chaffinch, greenfinch, linnet, and blackbird. These are the common nests selected by the cuckoo in our country. Others have been found thus undesirably distinguished abroad. The hedge-warbler, the pied wagtail, and the meadow-pipit are those most frequently selected with us, as their nests are not only numerous, but also not difficult to discover.

There is a great difference between the size of any one of these birds and that of the cuckoo; and if the egg were proportionately large, it might attract the attention of the outraged owner of the nest, and be deserted or expelled. It is a remarkable circumstance that the egg is, on the contrary, most disproportionately small compared to the

size of the bird. Dr. Jenner gave a minute but philosophical attention to the subject of the cuckoo's history; and he found, on weighing the largest cuckoo's egg he could obtain, that it weighed only fifty-five grains. The smallest weighed but forty-three grains. Of four specimens in Mr. Yarrell's collection, the largest only measures eleven lines and a half in length, and eight lines and a half in breadth. "This," observes Mr. Yarrell, "is the exact size of the egg of the skylark, yet the comparative size of the two birds is as four to one."

The invader generally deposits her egg during the period when the small birds whose nests she selects are occupied in the deposition of their eggs. In the case of the hedge-warbler, and of several other of these unfortunate birds which it thus distinguishes, the time occupied for the deposition of their eggs is about four or five days. During this time the cuckoo, who has probably been on the alert for a favourable opportunity, taking advantage of the temporary absence of one of the birds, slips her egg in, and hies away, leaving her cares behind her, and the object of them to the charities of a pair of strangers. This in-

trusion often occasions some discomposure ; for the hedge-warbler, at intervals, while she is sitting, has been observed to throw out some of her own eggs, or otherwise injures them so that they become addled. "But," says Dr. Jenner, "I have never seen the bird either throw out or injure the egg of the cuckoo."

The course of events from this time forward is well illustrated in one of the examples given by Dr. Jenner. A hedge-sparrow built her nest in a hawthorn bush in a timber yard. After she had laid two eggs, a cuckoo dropped in a third. The sparrow continued laying until she had laid five, her usual number, as if nothing had occurred, and then began to incubate. On inspecting the nest a few days subsequently, the period of the incubation of the cuckoo's egg being about fourteen days, it was found that the young cuckoo was the sole occupant of the nest. Underneath was a sad spectacle! One of the young hedge-sparrows lay on the cold ground quite dead, and it was only the fibrous materials surrounding the interior of the nest which, arresting the downfall of an egg, saved the life of another ; for on examining it, one end was found a little chipped, and the young

sparrow was quite alive. It was then returned to the nest, but in a few minutes it was thrust out and had again a narrow escape of being dashed to the ground, its progress having been again stopped by the margin of the nest. The cuckoo was then taken out, and this egg was placed in its stead. The old birds during this time flew about the spot, showing signs of great anxiety; but when the observer withdrew they quickly came to the nest again. In a quarter of an hour's time, the young sparrow was completely hatched, warm, and lively. The old birds were now permitted to remain undisturbed with their new charge for three hours, during which time they paid every attention to it, when their domestic tranquillity was again interrupted by the introduction of the cuckoo. The parents of the sparrow having been much disturbed by the intrusion made upon their privacy, for a time showed an unwillingness to come to it. However, at length they came, and in a few minutes again the young sparrow was turned out of its own home by the cuckoo. It was again restored, and again the impudent stranger turned the real inheritor of the dwelling out, and tumbled it to the ground.

The mode of accomplishing this action was very curious. The little bird by various manœuvres contrived to get the sparrow on its back, where making a sort of lodgment for it, it clambered up the side of the nest till it reached the top, where, resting for a moment, it threw off its load with a jerk, and quite disengaged it from the nest. It remained in this situation a short time, and appeared to feel about with its wings whether the business had been properly executed, and then dropped into the nest again. With the extremities of its wings the young cuckoo was often seen by this patient observer to examine an egg or a nestling, before it began its work of ejection. A number of experiments were made on different nests, and eggs were often introduced artificially; but the result was uniformly the same. Sometimes the ejector drops its burthen, and then has to begin all over again, with wonderful perseverance, until it has effected its object.

It is remarkable that the disposition for turning out its companions begins to decline from the time it is two or three, until it is about twelve days old, when it appears to be lost. The disposition to

turn out the eggs appears indeed to terminate earlier than this, as Dr. Jenner found that a young cuckoo nine or ten days old would suffer the eggs to remain unmolested in the nest, while at the same time it unceremoniously turned out a nestling from the nest. The shape of the young bird differs from that of other newly-hatched birds in a singular degree; this was considered by Dr. Jenner to be connected with the peculiar action it has to discharge. Its back is very broad, with a considerable depression in the middle. This depression appears to be formed for the express purpose of giving a more secure lodgment to the egg or nestling, which it has to turn out of the nest. When it is about twelve days old this cavity is quite filled up, and then the back assumes the shape of nestling birds in general.

The foster parents pay the young stranger, when hatched, all the attention in their power, and feed it with unwearied affection and diligence. Even when, by an artificial arrangement, the cuckoo was prevented from throwing its fellow-occupants out of the nest, and so the nestlings proper to the birds were preserved, they made no distinction, but fed all alike. The young cuckoo is a most voracious

feeder; and it may be questioned whether, if it had not recourse to its extraordinary plan of taking care to monopolise all the food to itself, the birds would be capable of rearing it up together with four or five querulous nestlings in addition. The lives of the latter are, therefore, sacrificed to the preservation of the one life of the former.

The destruction of eggs and young thus committed must be excessive, even in a single year. Mr. Blackwall has made some ingenious calculations, which give something of an idea of its amount. He says, the mean number of eggs laid by those birds that are usually selected by the cuckoos to provide for its progeny, is five. Now, the area of England and Wales may be taken at 49,450 square miles, which, reduced to square yards, gives 153,176,320,000. This, divided by 3,301,816 square yards, the area of the township of Crumpsall, and the quotient multiplied by 3, the mean number of female cuckoos for every 3,301,816 square yards, gives 139,173, the mean annual number of female cuckoos that visit England and Wales. This sum multiplied by 5, the mean number of eggs laid by the cuckoo, gives 695,865, the number of nestlings produced annually by the

mean number of females; and this product multiplied by 5, the mean number of eggs laid by those birds to whose care the cuckoos usually entrust their offspring, gives 3,479,325, the mean annual number of nestling birds destroyed by young cuckoos in England and Wales. Enormous as this destruction appears, it is probably rather under than over-rated. If the cuckoo had selected the nest of birds with a less numerous offspring than those small birds, it would have materially assisted to exterminate the species thus selected. Nothing is wasted in the operations of nature; and though at first thought it might appear that this is an exceptional instance, yet when we remember the large amount of food thus provided for various minute carnivorous animals who regale themselves upon the bodies of the young which have met this untimely end, the appearance of waste is removed. And if the lover of rural scenes and sounds were asked whether he would consider the loss of the cuckoo's falling third melody compensated for by the spared lives of the hedge-sparrow, and others, it may be questioned whether he would not choose the former of these alternatives, and assent to the sacrifice, that the music might not be lost to the

fields and woodlands. In any case, the matter is out of his hands; and it is enough for us to know that God has willed it so, and His will is both wisdom and love.

One of the most remarkable of American birds which is possessed of this disposition, and which, as we shall see, sometimes suffers punishment in the loss of its offspring for it, is the American cow-bunting. The actions of this bird are described in the following terms by Audubon. "When the female is about to deposit her eggs, she is observed to leave her companions, and perch upon a tree or fence, assuming an appearance of uneasiness. Her object is to observe other birds while engaged in constructing their nests. Should she not from this position discover a nest, she moves off and flies from tree to tree, until at length, having found a suitable repository for her egg, she waits for a proper opportunity, drops it, flies off, and returns exultingly to her companions. This bird does not make a forcible entrance, but watches its opportunity, and, when it finds the nest deserted by its guardians, slips to it like one bent on the accomplishment of some discreditable project.

The yellow-poll warbler resorts to a most

remarkable plan of punishing the intrusion; and its actions deserve a place among the highest indications of the instinct of the feathered race. Mr. Nuttall appears first to have noticed this remarkable part of its history. The egg, which is not unfrequently deposited before that of the rightful owner, is too large to be ejected from the nest. A different expedient for treating it is therefore had recourse to. The egg is ingeniously incarcerated at the bottom of the nest, a new lining being placed over it above, so that it is never hatched, to become the enemy of the brood. Dr. Brewer says, "I have known four instances in which a single egg had been thus buried by the yellow-bird's building a second story to her nest, and enclosing the intruder between them. In one instance three of the yellow-poll warbler's own eggs were thus covered along with that of the cow-bird and another; after an egg had been thus treated, a second was laid, which was similarly treated; thus giving rise to a three-storied nest." Audubon gives the following description of this remarkable structure. "A nest of the usual form had been constructed, of which the external diameter was three inches. It is composed of cotton,

rudely interwoven with flaxen fibres of plants, and lined with cotton of a reddish colour, with some hairs round the inner edges. The egg of the cow-bird having been deposited in this nest, another, of a larger size, three inches and three quarters in external diameter has been built upon it, being formed of the same materials, but with less of the flaxen fibres. The egg is thus surmounted by a layer of three-quarters of an inch thick, and was discovered by opening the lower nest from beneath. It is agglutinated to the lining of the nest, having been addled, and probably burst. In this second nest a cow-bird had also deposited an egg, which was in like manner covered over by a third nest, composed of the same materials, and of nearly the same size as the second." It is to be hoped that after these repeated trials the ingenious bird was allowed to have its nest to itself, and that it perfected its brood without the encumbrance of an unwelcome stranger.

Speaking generally, very little is known as to the time when birds deposit their eggs. In the case of small birds it appears to be most frequently at an early hour in the morning. When the period of egg-laying arrives, the bird generally continues

to deposit its eggs, after the first, at intervals within twenty-four hours. But some facts are on record which render it probable that the bird can, to a certain degree at any rate, restrain the deposition of its eggs, and lay no more for a time. Mr. Jesse says, in his Gleanings, "A wonderful fact respecting eggs is, that some birds have the property of either retaining their egg after it has arrived at maturity, or of suppressing altogether the further progress of the eggs which it would otherwise have laid in regular order. I have on several occasions purchased pullets for my farm-yards which had just begun to lay. Perhaps on their way to their new home they would drop one egg in the basket in which they were confined; but I have invariably found that, on arriving at a strange place, they have altogether ceased to lay any more eggs till they had become habituated to their companions, and had made themselves acquainted with the localities of their new situation." It is added, that the probable cause of this is their restlessness, and not knowing where to go at first in search of what was necessary to enable them to bring their eggs to perfection. The subject is still in great obscurity, and it is impossible to state

anything as to the probability or otherwise of the explanation just given.

A number of instances are recorded where more than one set of eggs have been deposited in one season. A single pair of birds, if unmolested, will generally only produce one set or lot of eggs; but if their nests are accidentally destroyed, or if the same circumstance happens, or indeed if the eggs are intentionally removed, in particular cases several, two, three, or even four separate lots of eggs may be deposited. These eggs, however, are produced by an extraordinary and not by an ordinary combination of circumstances, and must be considered accordingly as an effort of nature which is, in most instances, contrary to the common rule. The numbers laid by various families of birds will come under notice in the next chapter.

We must hasten to close our chapter on the deposition of the egg. Our attempt has been to show, that at this epoch in the Life of a Bird a new set of impulses begin to animate it, leading to the bird's taking the first step towards bringing a brood of its own species into the world, and during which various interesting particulars connected with the actions of birds in the deposition of their eggs

have been noticed. We may quote, in conclusion, from one of Mr. Jesse's works, a little anecdote which will serve to show that birds regard their eggs with much affection, and are, on occasion, ready to protect them with courage and activity. A crow was seen to alight on the edge of a canal adjacent to Writtlelodge, in Essex, near the nest of a moor-hen. Immediately the male bird flew at him with such force as to knock him over, and continued to attack him with so much spirit, that in less than a minute the crow flew away. The hen had laid three or four eggs, and there is little doubt that the crow intended to rob her nest. The anecdote is highly creditable to the paternal affection and energy of the bird, whose home was threatened by this enemy.

CHAPTER II.

NUMBER, SHAPE, SIZE, AND COLOUR OF EGGS.

IT now becomes necessary for us to descend into a few particulars relating to another, though not less important part of Bird history. If the woods are free to us, we may wander through them at bird-nesting time, and take a look into the varied structures which lie hid among the green shades, buried in the covert. If we took down the particulars relating to the number and size of the eggs of various species into whose nests we had glanced during our excursion, we should find much to interest and instruct us ere we reached home again. How contrasted the eggs of the wren, so small, so delicately white, with a sprinkling of red, pin-point spots, with those of the rook, mottled over with blotches of dirty green on a ground of lighter green; and how different both of these from the large and delicately green-tinted egg of the heron, or the pale and subdued yellow egg of the pheasant!

With regard to the number of eggs produced by different kinds of birds, no systematic account, with which we are acquainted, has as yet appeared. Yet it is well known to ornithologists, that the number of eggs in different orders, families, and species of birds, while almost constant for each, differs considerably between one order and another, and between the various families and species of each order. The following account of the numbers of eggs in different orders of British birds may be taken as an imperfect approach to a representation of the average numbers of eggs for each family:—

		1	2	3
RAPTORES, or Birds of Prey.	Vulturidæ x..... (Vultures).....	3	2	
	Falconidæ x..... (Eagles, Hawkes)	3	2	5
	Strigidæ x..... (Owls)	4	3	5
	<i>Dentirostres.</i>)			
INSESSORES, or Perching Birds.	Laniadæ x..... (Shrikes)	5	4	6
	Muscicapidæ x..... (Fly-catchers)	6	4	8
	Merulidæ x..... (Thrushes, &c.)	5	4	6
	Sylviadæ* x..... (Redbreast, Whinchat, &c.)...	6	4	8
	Paridæ (Titmice)	10	7	16
	Motacillidæ x..... (Wagtails)	5	4	6
	Anthidæ x..... (Pipits)	4	5	

* *Exception*, Gold-crested Wren, 11.

		1	2	3
INSESSORES, or Perching Birds— <i>continued</i> .	<i>Coniostres.</i>			
	Alaudidæ..... (Larks)	4	3	5
	Emberizidæ (Buntings)	5	4	6
	Fringillidæ (Sparrows, Finches, &c.)	5	4	6
	Sturnidæ (Starlings)	4	5	
	Corvidæ (Crows, &c.).....	5	4	8
	<i>Scansores.</i>			
	Picidæ (Woodpeckers, &c.)	5	4	10
	Certhiadæ (Creeper, Wren, &c.)	8	7	5
	Cuculidæ (Cuckoos)	5		
	<i>Fissirostres.</i>			
	Meropidæ (Rollers)	6	7	4
	Halcyonidæ (Kingfishers)	6	7	
	Hirundinidæ..... (Swallows)	4	5	8
	Caprimulgidæ.... (Nightjars)	2		
RASORES, or Gallinaceous Birds.	Columbidæ (Doves, &c.).....	2		
	Phasianidæ (Pheasants)	12	10	14
	Tetraonidæ*..... (Grouse).....	10	8	12
	Struthionidæ (Bustards).....	2	3	5
GRALLATORES, or Wading Birds.	Charadriidæ (Plovers, &c.)	4		3
	Gruidæ (Cranes).....	2		
	Ardeidæ..... (Herons, &c.)	3	4	6
	Scolopacidæ (Curlews, &c.)	4		2
	Rallidæ (Rails, &c.)	9	10	5
	Lobipedidæ (Phalarope)	4		

* *Exception*, Partridge, 10—20.

NATATOES, OF
Swimming Birds.

		1	2	3
Anatidæ*	(Geese, Ducks, &c.)	9	7	12
Colymbidæ	(Grebes, &c.)	4	5	
Alcadæ	(Guillemots)	1		2
Pelicanidæ†	(Cormorants)	4	5	
Laridæ‡	(Terns)	3	2	

The numbers in the first column denote the mean number of eggs for the family; those in the next, the most common next number; and in the third, the limit either at which they commence or terminate.

On casting the eye over these figures it is difficult to detect anything like an established rule or set of rules, according to which the numbers of eggs are distributed. Certainly these figures do not discover to us the principle upon which this allotment is based. Yet we perceive something of a law, which has received the assent of naturalists, without much inquiry as to its correctness. It has generally been said that the number of eggs produced by birds increase in proportion to the diminishing size of the mother. The wren, for example, produces from seven to eight eggs, according to

* *Exception*, Swan, 3. † *Exception*, Gannet, 1. ‡ *Exception*, Petrels, 1.

several naturalists, a larger number; the eagle generally only two; the titmouse sometimes as many as sixteen; the vulture and the crane only two. Were we to form a rule, therefore, upon these instances alone, it would run, according to the tenor of the above proposition, namely, that small birds generally produce a greater number of eggs than large birds. Running over the columns given above, this rule appears to have somewhat of a general application. The swan lays but three eggs, the heron family also three or four, less frequently six. Again, the red-breast lays six, the stone-chat five or six, and the gold-crested wren ten or eleven eggs. Let us now contrast the respective sizes of these birds. The common white swan (male) is from four feet eight inches to five feet in length, and weighs about thirty pounds; the white stork measures three feet six or eight inches in whole length. The whole length of the red-breast is five inches and three quarters, that of the stone-chat five inches and one quarter, and the gold-crested wren only measures three inches and a half.

Yet, on a more careful review of the same facts in figures, we are presented with at least an equally

remarkable number of exceptions on the opposite side. The common pheasant measures—exclusive of the tail, which is sometimes two feet long—a foot in length, yet this bird lays a larger number of eggs than the little wren, only three or four inches long; the latter, as has just been related, depositing seven or eight eggs; while the pheasant lays from ten to fourteen. The bean-goose, measuring in extreme length thirty-four inches, lays six or seven very large eggs; while the song-thrush, which is doubtless a small bird by its side, lays but four, sometimes five eggs. The partridge, again, cannot be reckoned, comparing it with the skylark, a small bird; yet its number of eggs sometimes amounts to twenty—about the largest number deposited by any bird, while the skylark frequently only lays three eggs.

Several species of the petrels, the gannets, and the guillemots, present us with instances in which only one egg is laid. The whole length of a fine specimen of a petrel is about seven inches, the whole length of the gannet is about thirty-five inches, that of the guillemot about eighteen inches. The golden eagle is a larger bird than either of these, and a monster by the side of a petrel; yet,

this bird lays two, and sometimes three eggs. These form grave exceptions to this generally received rule as to the number of eggs and the size of the parent.

Not to multiply instances of the same kind, we may content ourselves with observing that the extreme limits of the kingdom of birds, in point of size, present us with the most remarkable exception to the above rule that can be conceived. The ostrich, the greatest of birds, lays about seven eggs; while the insect-like humming-bird deposits only two delicate eggs in its tiny nest.

It results from these considerations that the rule has so many exceptions as to be almost valueless in point of accuracy; and some other principle must be laid down, if we would define the laws which regulate the number of eggs in the various families of birds. In all probability the number of the eggs of birds, which is in effect the same as the abundance or scarcity of the members of an individual family, has been wisely regulated by the Author of Creation, with a view to the accomplishment of certain great objects in the scheme of being. We shall be more in the right track if we seek for the explanation, or, at least, for a partial

explanation, of the varying numbers of eggs, in the study of the habits than of the size of birds. And we can well understand that were the eagle as numerously brooded as the tit-mouse, we should soon be robbed of most of the music of our groves. Interesting, however, as this inquiry is, it is removed from our unpretending pages by the complex nature of the speculations into which it would lead us.

We may learn from the tables above given an equally interesting, and not less important series of facts about the number of eggs laid by birds. This number is constant for an individual species—constant, that is to say, within certain narrow limits. Thus it was never known that an eagle deposited six or seven eggs during one season; and a naturalist, spying a nest of one of these birds high out of reach, might confidently predict that if it contained either eggs or young, there would only be two, or at most three. Neither, again, do we ever hear of a kitty-wren laying only one or two eggs, and then incubating. The reader may not have before reflected on this fact, yet it is one of great interest to the natural theologian,—to him, that is to say, who loves, with Cowper, to trace the

hand of the Great Author in all the realms of nature, and who, with him, can exclaim—

Nature, enchanting Nature, in whose form
And lineaments divine I trace a hand
That errs not, and find raptures still renewed.

A bird's nest, with its eggs, supplies an argument that no infidel reasoning can overcome, as to the existence, wisdom, and laws of God. Passing by the miracles of its structure, and adaptation to the wants of its present and future occupants, we need but to count the eggs, to be furnished with an unanswerable testimony to the doctrine, dear to every lover of his Bible,—of the unity of God, and of the evidence of design and law in His creation. Had all things been produced by chance, the eggs would have been this year of this number, and the next of one far removed from it. How different from the fact! In a number of cases the utmost assurance may be felt in stating the number of eggs which a given species will produce; it will not fall short of this, nor exceed that sum. Of the family to which the plovers belong, it might be said, with unerring confidence, that the number of eggs in their nests would, in nine cases out of ten, be four, and in the tenth three; and in no instance,

except by accident, would there be two, five, or six. It is plain a law exists, and exists by Divine ordinance, that the robin and the wren, equally with the monarchs of the winged world, are to produce a certain fixed and scarcely variable number of eggs.

Yet, while this rule is constant in its application to birds in their natural condition, and when not interfered with by accident or other circumstances, it is subject to some highly remarkable exceptions. Colonel Montagu says, "birds will only lay the number allotted by nature, and no more for a time. If, however, it is unable to incubate, the bird will begin to lay again, and will deposit the usual number, or less—the latter most frequently—and again cease." There thus appears to be a sort of confirmation of the rule, even in its very exceptions; for, when more eggs than the number allotted are deposited, it is supposed that a second or a third course of laying has commenced. Colonel Montagu disbelieved the assertion, that a bird would go on laying one egg after another without an interval of a few days, when the eggs were designedly removed. At the expiration of this interval he believed a new course

of laying to commence; and, therefore, the eggs now laid were a fresh nest, not a continuation of the old.

Yet there are some accounts given which surround this view of the case with unexplained difficulties. A correspondent of the Zoologist narrates the following circumstances. A few years since, in a hole in an old ash tree, a single white egg was discovered, without any trace of a nest. This egg was then removed, and in passing the next day the observer had the curiosity to look into the hole, when, to his astonishment, another egg was found. This was also taken, and from that time the tree was daily visited, and each day an egg was removed until the extraordinary number of twenty-two had been taken away. After this not another egg was laid. The parent-bird appears to have been the wryneck.

In the Magazine of Natural History a somewhat similar account is given by Mr. Salmon, and quoted in Mr. Yarrell's excellent work on British Birds. Wishing to obtain the eggs of the wryneck, a pair, which frequented a garden in a village in Norfolk, for the purpose of incubation, was very narrowly watched. They selected a hole in a

decayed apple-tree for this purpose. The entrance being too narrow for the admission of the hand, and the tree being hollow and decayed at the bottom, the nest was got at by thrusting the arm upwards. The nest was composed of moss, hair, dried roots, &c., and was apparently the old nest of another bird. It did not contain any eggs, and was therefore returned by thrusting it up inside the tree. On passing by the same tree a short time subsequently, attention was arrested by one of the birds being observed to fly out of the hole. Upon again withdrawing the nest, it was found to contain five most beautiful glossy eggs, the shells of which were perfectly white, and so transparent that the yolks shone through, giving them a delicate pink colour. The nest was again replaced, and visited during the ensuing week. It was again examined, and found to contain six more eggs! These were taken away, and the nest was replaced. In the following week the same examination was repeated, and four more eggs were discovered. In ten days time the nest was again withdrawn, for the fifth time, and now contained seven eggs. Thus, altogether, within a month this bird produced no less than twenty-two eggs!

In these instances there was no interruption, as far as could be ascertained, to the process of laying, yet it is remarkable that in both, the total number laid was precisely the same. The ordinary number of eggs laid by the wryneck is from six to ten. It is at least conceivable that three short intervals might have occurred; the first when ten had been laid; the next after five, and six.

Other instances, of a somewhat similar bearing, are related. Ray states that a swallow has been known, by the subtracting daily one of her eggs, to have laid nineteen successively, and then to have ceased. A hedge-sparrow has been robbed of twelve eggs before showing any inclination to sit. "The same," observes Mr. Jesse, "has been noticed with regard to the blackbird, lark, and long-tailed titmouse, (and, it is said, the wren likewise.)" The titmouse has gone on to lay as many as thirty eggs before she began to sit. "In the case of the lark," says the same author, "if only one or two eggs are allowed to remain in the nest, the bird will go on to lay for a time indefinite, but if there are three she will sit. The usual number of eggs in a lark's nest is five." It may be questioned, however, how far this statement is in accordance with fact—that

any bird should continue to lay eggs for an indefinite period appears altogether opposed to all that we know of the functions of these creatures. If the parent is robbed of her eggs she is said to continue laying for ten or twelve days, and sometimes for more.

A thrush's nest was discovered one Saturday, and then contained one egg. On the next day the nest was destroyed and the egg stolen. On the following day a new but very rudely formed nest was constructed, in which one egg was laid. During the whole of the next day there was no egg added, but on the following there were three. The observer, who mentions this fact, states that he was acquainted with an instance in which two hen pheasants laid the enormous number of ninety-two eggs in one season. But in this instance, as in that of the common fowl, we must consider the bird as under the influence of domestication, which produces singular influences upon the habits of animals. In a state of nature such an occurrence would be impossible.

Yet, even in the case of wild birds, the constant disturbance of them by man serves to produce almost the same result with regard to the number

of their eggs. Mr. Waterton informs us, that it is believed among the rock-climbers on the coast near Flamboro' Head, whose avocation is the collection of the eggs of the guillemot and razor-bill, that the former bird, when undisturbed, never lays more than one egg. If this is taken away, she will lay another; and if she be plundered of that, she will then produce a third; and so on. Audubon states a similar fact with regard to the clapper-rail of America. In the Jerseys it forms a regular occupation to collect the eggs of this bird; and it is not an uncommon occurrence for an egger to carry home a hundred dozens in a day. Audubon himself has collected seventy-two dozens in a day. After the nest has been robbed, in a few days, more eggs are deposited, though not in the same nest.

In all these cases it is evident that the natural processes of the bird are interfered with. Although it is undoubtedly true, that some birds can be made to lay a larger number of eggs in the aggregate than they would ordinarily do, this exception only goes to confirm the rule, and to impress yet more strongly upon us the conviction, that a fixed number is the ordinance of nature; the

variation being a result of accident, and not otherwise to be found. The probability also remains, that in most instances where a larger number than usual has been artificially brought about, a new set of eggs is produced, and produced by a stimulus, which in ordinary cases could not have taken place. It is well remarked, nature invariably pursues one course. Therefore, to draw a general rule of her actions, we must strictly adhere to her in an unmolested, uncultivated state; for if we deviate from that, we must infallibly err.

The inquiry with respect to the size of eggs remains in precisely the same unsatisfactory state as we found that of their number, ornithologists having paid very little attention to the collection of any general facts upon this department of their science. As it is, the proportion between the size of birds and that of their eggs, is only recognised by a sort of floating knowledge, the rules of nature remaining still in a great measure unknown. It may be taken as a general rule, that the egg of a bird bears a proportion to its size. The egg of a wren and that of an eagle have each their proportion to the size of the parent. Yet, to the most

casual observer of a collection of eggs, it is apparent that this proportion is very far from being the same in different families and species. Let us take, for instance, the egg of the great auk. This enormous egg measures four inches and ten lines, or nearly five inches in length, and two inches and three-quarters in breadth. This bird is about the size of a fine goose. That of the golden eagle, a much larger bird, is only three inches long, and two inches and a half broad. The egg of the Fulmar petrel, which is a small bird by the side of the king of birds, is longer and larger than that of the latter. The common guillemot lays an egg which is a quarter of an inch longer than the golden eagle's, though of a smaller diameter.

The ordinary egg of the guillemot varies remarkably in size, and in its other characters; but it is always very large in proportion to the size of the bird. Mr. Hewitson found one of an immense size. It measured in length over the surface of the egg five inches, and in circumference seven inches and a quarter. The size of the guillemot's egg is most striking when compared with that of the other birds. Mr. Hewitson, in

weighing the eggs filled with water in comparison with other eggs also filled with water, arrived at the following results:—The weight of the bird itself is about twenty-four ounces, that of its egg three ounces and seven drachms; the weight of the large egg just mentioned is five ounces, seven drachms, and forty grains. The weight of the common crow is about nineteen ounces, that of its egg is only five drachms and forty-nine grains. The weight of the ring-dove is twenty ounces, that of its egg five drachms and thirty grains.

It appears probable that an accurate investigation of this subject might lead to some interesting results; although without positive data for the establishment of a general rule, from such examinations as we have made, it seems to be the rule, that the eggs of Raptorial birds are less in proportion to the size of the parent than those of the Natatorial birds; among the latter of which, the largest specimens of eggs in the zoology of our own country are to be found. The remarkable disproportion found in the eggs of the cuckoo, in contrast with the magnitude of the parent, has been already considered. In this instance, a

special exception, intended to meet a special circumstance, is to be found.

The guillemot and the raven, observes Mr. Hewitson, are themselves of about equal size; their eggs vary as ten to one. The snipe and the blackbird differ but slightly in weight; their eggs differ remarkably. The eggs of the snipe equal in size those of the partridge and the pigeon.

That there is a cause for these variations in size, no one will question. Birds, in being hatched and emerging from the egg into the world, are in very different states of preparation for their future part in life. Some are soon fit to leave the nest, and to wander out into the world alone; others require long tending and careful education on the part of the parents, in order to harden their frames, and to fit them for contending alone through life. What a sad condition were that of the newly-hatched guillemot, born on a bare ledge of rock, and imminently in risk of being blown over the edge into the waters beneath, or dashed upon the rocky pinnacles below its birth-place, if it were to spend an infancy as prolonged as that of the young eagle, safe in his home of

sticks from every accident of wind and weather! Hence it appears obvious, that preparation must be made in the shell for the circumstances to which the future being is to be exposed, in the one case; while in the other, as it is to be long under parental care, no such preparation is necessary, the accidents to which, in the latter case, it is exposed, being few and trifling in their nature, compared to those which the former lie at the mercy of. That this development in the shell requires a larger amount of space than is required when it proceeds to a lower degree, is obvious. Yet, in consequence of the peculiar form of the egg as adapted to that of the future body it is intended to contain, very little space is lost; and the parent bird, when incubating the largest eggs, is well able to cover them so as efficiently to supply the necessary degree of animal heat.

Let us glance at the absolute size of various eggs, without reference to that of the bird. That of the great auk, the size of which has just been given, must be taken as the largest among British birds. Of existing species, that of the ostrich is undoubtedly the largest. Its shell is very dense and strong; and it weighs sometimes as much as

three pounds. The shell is in fact so hard as to be employed for drinking utensils, being often ornamented with singular devices, and set in various ways. Several large shells are to be seen at the British Museum, some of which are as large as a child's head. The eggs form a favourite article of food among the Hottentots; and are cooked in a very natural method, by setting the egg on a fire in its shell, and stirring the contents with a piece of stick. One of these eggs forms a good meal for a single person.

The largest known eggs are those of the gigantic moa of New Zealand, that enormous extinct bird which has been the subject of so much speculation to the geologist. A perfect egg of this bird has not been found; but in a recent communication from a son of Dr. Mantell's, it is stated that numerous pieces of egg-shells have been discovered, some of which are now in Dr. Mantell's possession. From those it appears that the general form of the egg resembles pretty closely that of the ostrich. Like it, its surface is marked, though not with the same sort of marks: these eggs presenting the appearance of little groups of straight lines — the shell of the ostrich being

pitted with holes of no great depth. From the pieces which have been collected, some idea also of the size of the egg may be obtained; and this is best realized in quoting the expression of the discoverer of the shells,—“A hat would have formed a good egg-cup for it!” The egg must consequently have been larger than that of any known species of bird.

The least of the British birds is the gold-crested wren; and its egg is smaller than that of any other bird found in our country. In length it measures half an inch, and in diameter five-twelfths of an inch. The next smallest are those of the long-tailed titmouse, which, white bespeckled with pale red spots, only measures seven-twelfths of an inch in length, and five in breadth. Starting from this diminutive size, the dimensions of the eggs of our British birds rise with the most gradual succession of change until they reach the largest admeasurements. The least known eggs are those of the humming-bird. In one of the table-cases at the British Museum, will be found the exquisite structure and egg which form the original from which the accompanying drawing was taken. In a little cup of the smallest dimen-

sions, an egg is seen, which much more nearly resembles a large comfit than an egg. Oval in

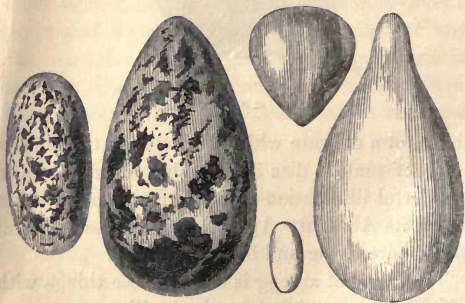


Nest of Humming-bird.

shape, of a delicate white flushed with the faintest tinge of pink, it lies in its fairy resting-place, a wonderful illustration of the narrow bounds within which its Almighty Author can compass the germ of a future living and beautiful being.

The shape of an egg is one of those things with which we are most constantly familiar; every person recognises it as an oval, of which the one end is large, the other small and tapering. Yet, while such is the prevailing form, there are a large number of eggs which exhibit a different, and some a singular outline. If we take the hen's egg as a

kind of type, and contrast it with those of other species of birds, it will be found that the oval form assumes a variety of different aspects; so that, while all eggs present somewhat of this character, yet, in some, this feature is departed from to a greater degree than in others. The most remarkable of these varieties in form, are placed in contrast in the adjoining cut.



The flowers which adorn the fields scarcely vary more in respect of their colour, than do the eggs of various tribes of birds; but the colours which adorn eggs fall far short of those which paint the flowers. In vain shall we look for an egg

which can be compared to the rose, or tulip, or other flowers of even gaudier hues than those possessed by these. The colours of eggs are more subdued, less staring, and altogether of feebler lustre than those of flowers. This arises, in some degree, from the material on which they are impressed, the calcareous coating being less adapted to exhibit colouring than the waxen structure of the flower, every cell of which is full of juice reflecting light through the painted cell walls. But the colours of many eggs are extremely beautiful nevertheless, and, for softness of tint, may endure comparison with any human production; the glistening varnish-like coating, beneath which the colouring matter is deposited, adds greatly to their beauty; in some instances this glistening coat is so beautiful, as to give the eggs a burnished or even metallic appearance.

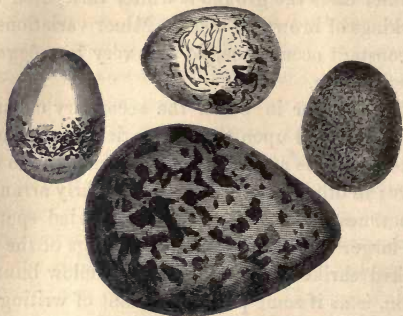
The egg of the golden eagle is one of some beauty and variety of colouring; irregular blotches of chocolate, of pale pink, and of yellow, variegate its surface. Many eggs of the falcon family are of a rich brown colour; that of the buzzard somewhat resembles those brown shells which form the constant ornaments of the country mantel-piece,

and which are now and then sold in the streets of London, after having undergone the extraordinary metamorphosis of being converted into tortoise-shell-cats, receiving an artificial tail and ears. The eggs of the Insessorial division of birds exhibit a great variety and some brilliance of colouring. Those of the fieldfare are very beautiful, the ground a pale blue, spotted over with markings of yellow, pink, and brown. Those of the grasshopper warbler are still more beautiful, consisting of a delicate mixture of soft lilac and pink spots; the egg of the titmouse has the same tints, but with greater boldness and distinctness. The egg of the tree-pipit has a rich claret colour. The eggs of the skylark are occasionally of a grass-green freckling. Every schoolboy is acquainted with the ugly green of the crow's egg. The eggs of the red grouse often present singular varieties of colour; the surface of some resemble the spots of a leopard, that of others being suffused with a deep claret colour. The herons produce beautiful pale blue eggs. Perhaps the most beautiful of all eggs are those of the guillemot: none can vie with them in variety and richness of colouring; in some instances the ground is the most beautiful pale blue, spotted

over with well-defined marks of black or brown ; in other cases the ground is white, variegated with markings of brown or black. Minor variations are of constant occurrence, so that very few eggs are exactly alike.

The manner in which the secondary colour or marking is laid upon the egg varies greatly, also ; sometimes it is as irregular as it is possible to conceive ; in other cases it is very regularly arranged, sometimes in a broad ring of sprinkled spots at the larger end, as in the beautiful eggs of the red-backed shrike. The egg of the yellow bunting, again, is as if some person ignorant of writing had scratched it over with pen and ink, letting a drop or two fall in addition. Sometimes the colours seem to have been put on, and then half obliterated by washing. The egg of the plover furnishes us with an instance of well-marked distinct blotches. A number of eggs are besprinkled over with the secondary colour, so as to wear a distinct resemblance to the rind of an orange. These varieties are attempted to be shown in the cut, but a coloured illustration could alone convey the idea distinctly. A large number of eggs are totally devoid of colour, being of the most pure and beau-

tiful white; many eggs, also, are without a second-



ary colour, but the majority of eggs are ornamented with two or three colours.

The seat of colour in the eggshell is partly in an external layer of small cells, called the *Epithelium*, and partly in the deeper layers; the colouring matter is supposed to be contained, like that of the skin of a negro, in minute cells, which are called pigment cells. It has been found, by chemical experiments upon the beautiful egg of the guillemot, that the colouring matter consists, in that case, chiefly of manganese, iron, and

silica. Copper has also been detected in those spots which variegate its surface.

No person can examine a collection of eggs without, in a very short time, becoming satisfied that there is a certain family likeness among all those which belong to a true genus. It is almost as difficult to define in what this general resemblance of the eggs of a genus of birds consists, as it is to define that subsisting between the members of a human family, where a general resemblance is often to be traced among individuals in many respects differing from each other. In a communication to the Zoological Society by W. Yarrell, Esq., and kindly furnished by him to the author, the following are the considerations to which this distinguished ornithologist has arrived. First, that the colour and markings which we find deposited in the external surface of the shell afford indications by which the classification of genera of birds may be assisted; and, secondly, that the eggs of species belonging to the same genus will resemble each other in colour and markings, whatever may be the geographical locality in which such species are found. Exceptions and discrepancies may be pointed out, but the application of this prin-

ciple as an aid to the classification of birds is found to be valuable on the whole; and it is gratifying to find that, were we to take the eggs of British birds as our only guide, with the exception of a few instances, we should arrive at the best and most approved arrangement of the different genera. When it is remembered, that, after all, the egg of a bird is in reality one stage or condition in the life of the being, surprise need not be felt that the eggs of different kinds of birds differ from each other, or that those of one kind or genus have a family resemblance to one another. The greater marvel is, that they do not differ more among the different genera than we find to be the case. The eggs of insects differ much more remarkably in their various genera than do those of birds, and some of them are among the most charming and beautiful objects in creation, when beheld with the assistance of a lens.

CHAPTER III.

STRUCTURE OF THE EGG.

IN order to obtain a clear idea of the structure of the egg,—to the study of which the present chapter invites us,—the reader may provide himself with a few eggs of the common barn-door fowls. Taking one of these into the hand, and gently tapping it with any hard body, it will be possible after a few trials to separate a part of the shell from the white membrane beneath. By a little patient management, the broken pieces may be detached even without opening the egg, for a space of the size of a sixpence; but in so doing the utmost caution is necessary, as an unlucky thrust of the nail or penknife employed to separate the shell would rend the delicate membrane which it protects, and permit a part of the contents of the white of the egg to escape.

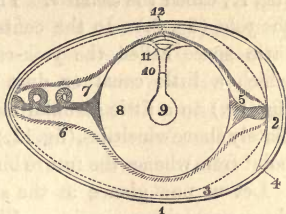
We have now obtained evidence that the egg is furnished with two kinds of envelopes, an outer hard and stony one, which we know by the name of the shell, and an inner delicate membranous lining, which is in reality composed of at least two layers, an outer and an inner one. On cutting



and turning the membrane back, a very pretty spectacle is presented to our view, which the artist has attempted to render in the accompanying cut. Since, however, the real object is so easily to be seen, it is to be hoped the reader will not fail to study it, returning to the accompanying diagram

for the purpose of rendering his knowledge of the parts perfect. Floating in the pure and transparent "white," the golden yolk is seen moored on each side by little thickened portions of the white which hang to it. In the centre of this beautiful yellow ball is a minute round speck, indicating the point where life in the egg is to begin. This examination, simple and rude as it is, presents us with an

outline of the most important parts in the structure of the egg. It is however necessary that, in order to give a clear and distinct idea of our subject, we should describe with a little more minuteness their various



parts. The annexed cut will in so doing greatly assist the memory, by impressing a clear view of the general contents of the egg, with the names of its various portions.

Outermost of all is the hard encasing structure or *shell*, (fig. 1.) At the broadest end of the egg is an empty, or rather air-filled space, called the *air-follicle*, (fig. 2.) Within the shell is disposed the *shell-membrane*, which divides into two layers at fig. 4, and by the interval thus left the air-follicle is formed. Surrounding the yolk, and between it and the walls of the shell, is a thicker middle part of the white, the boundary of which is marked by fig. 5. Next to the yolk is a still thicker part of the white, contained within the line, (fig. 6.)

At each side of the yolk are the vital portions, (fig. 7,) called the *chalazæ*. These are attached to the *yolk*, (fig. 8.) In the centre of the latter is a little space called the yolk-cavity, (fig. 9,) from which a little canal or duct proceeds upwards, (fig. 10,) to a little glanular mass, (fig. 11,) immediately above which lies, (fig. 12,) *the germ*, the minute point from whence the future bird is to be produced.

Let us now glance at the structure of each of these parts in succession. First, as to the shell. It cannot have escaped the notice of those who have given even a small degree of attention to the familiar objects by which they are for ever surrounded, that the texture and appearance of eggs, exclusive of their colour, is greatly different in different instances. There is a difference perceptible to the attentive eye between the characters of the respective eggs of the common fowl and of the duck. Quite distinct from their respective colours, and shapes, and sizes, there is a difference of what we can call by no more appropriate title than *texture* between these eggs, and this becomes still more evident in the employment of a lens. The eggs of a crow, again, differ in some degree from both. These appearances have been considered

by several distinguished naturalists to be of some importance, and in many instances to form a certain character by which the family to which they belong may be known. Into this subject it becomes us not to enter ; but it may be instructive to make a few general observations upon the eggs of a few families of birds, intended to show the singular diversities of the texture of the shell displayed in them.

On close examination, it is seen that the eggs of the common domestic fowl are furnished with a shell, which in many instances appears dotted over with minute points, like the depressions caused by the point of a pin. In those of the guinea-fowl this appearance is still more developed, giving the egg a singularly spotted look. The eggs of the Turkey present somewhat of a similar aspect. Those of the pigeon, on the contrary, are smooth, glittering, and to the eye free from those pin-point depressions ; while those of the ostrich exhibit them of all others the most distinctly. The texture of this vast egg is quite peculiar ; from its density and colour it almost resembles a bony structure. Those to whom the aspect of the human skull is familiar, when denuded of its cover-

ing, and by age having acquired a certain polish and yellow tint, will be struck with the close similarity of character between it and the ostrich egg; the minute foramina in the skull, which give passage to the blood-vessels, producing in it the same perforated look as that of this bird's egg. The surface of the eggs of the extraordinary bird of New Zealand called the moa is marked with regular depressions, which give it a curious aspect. The eggs of the emu are likewise marked in a peculiar manner. The egg of the singular Australian bird, the megapodius, concerning which some interesting



Egg of Megapodius.

particulars will come under notice in another page, has a curious texture. It is of a dull, unpolished aspect, and looks earthy and chalk-like, though of

some apparent compactness, and is often stained, probably from the materials which surrounded it. An egg of perhaps the most exquisite and lovely character of any known is to be found in one of the cases at the British Museum, under the title of *Crypturus*; it is placed among the gallinaceous eggs. The texture of this egg is remarkable for its splendid polish; so high is its lustre, that it has all the appearance of being varnished, and, being of a chaste and subdued chocolate colour, it presents an appearance not unlike that of some work of art. By its side is another egg of a similar character, but tinted blue. The common partridge of England, and still more remarkably the *Perdix dentata* of Brazil, produces a smooth egg of beautiful texture.

Many of the eggs of the wading birds, (*Grallatores*,) have a character the very opposite of these. Their texture is smooth, but the eggs are dull-looking, and not unfrequently resemble coloured wares of dried chalk. The eggs of the spoonbill, in particular, partake of this chalk-like appearance, and are rough in their texture. Many of those of the heron resemble pieces of chalk of that size, coloured green. The Cyrus crane of India, again,

has a glistening egg, resembling in its texture that of the turkey. The *parra* of India has a most beautiful and singular egg. In shape it exactly resembles the figure of a balloon, one end being very broad, and the other very tapering. It shines with a metallic lustre, and has a curious bronze-like aspect.

The texture of the eggs of many families of the swimming birds, (Natatores,) is characterised by an appearance like ivory. That of the swan, both by its colour and smoothness, has a strong resemblance to an oval of unpolished ivory, the texture being of the smooth and soft-feeling character peculiar to that substance. The eider duck's egg is another beautiful example of the same fact. The egg also of the common duck bears this character. Now and then, however, a remarkable exception occurs in the character of the duck's egg. Several singular specimens of this kind exist in various collections; in one inspected by the writer the egg presented nothing of the usual ivory smoothness, but bears a strong resemblance to the rough aspect of the rind of an orange; its colour was also black, or a beautiful brown. This roughness, however, was merely an external coating, and could

be scraped off with a knife, the usual white of the shell appearing when it was so treated.

Yet there are also several families belonging to the same division of birds, the texture of whose eggshells is rough and chalky. The egg of the guillemot presents the appearance of a lump of chalk, variegated, however, oftentimes with the most beautiful colours. The single great egg of the great auk is so porous-looking as to resemble a mass of unglazed porcelain. Those of the cormorant consist of two layers of calcareous substance,—an outer layer which is soft and white, and may be scraped off with a knife, and an inner more compact layer, revealed in so doing, and of a blueish white. The single egg of the gannet is constructed in the same manner, of a double calcareous shell, the outer soft, and often marked with the impressions of scratches by rubbing against the material on which it lies, and the inner is a harder case, or the shell proper. The egg of the albatross is rough, like a fine-grained sandstone.

The texture of the smaller birds among the perching divisions, (Insessores,) is often delicate and beautiful to a high degree. The eggs of the kingfisher are like little white rounded oval

balls of china-ware, glittering in a remarkable manner. Those of the nightingale, olive-brown in colour, are beautifully smooth and polished in texture. The most beautiful of small eggs, not excepting the charming little ones of the titmice and the wren, are without doubt those of the tailor-birds of India: these may be seen at the British Museum; their surface is smooth, softly polished, and their exquisitely coloured chocolate, flushed with a transparent pink, renders them most beautiful specimens of these productions. The delicate texture of the eggs of the swallow, of many of the finches, and of a number of the commoner birds, may be so easily appreciated by obtaining them, and are so difficult of description, that we may be spared the attempt.

Among the highest division of birds (Raptores), none of the eggs which we have been able to examine seem to call for any special remark. They are generally smooth, sometimes chalk-like, and sometimes polished in their appearance; those of the owl often bear this character. Some of the shells of the large birds are rough.

We have seen eggs of some of the larger birds, and large eggs of other birds, the surface of

which presents a marked exception to the ordinary appearance of the eggs of birds, and assimilates them, in some degree, to the sculptured eggs of insects, only that the carvings in the latter exhibit a greater regularity; they are also constant, while these, in some cases at least, are exceptional. The surface of the shell presents a granulated or sculptured look, but there is that absence of regular marking and configuration in the sculpturing which indicates the fact of its being oftentimes accidental in its origin; the accident, however, of its production, taking place before and not after its extrusion. Sometimes the egg-shells of the titmice will present a singular patch, or more patches than one, of a yellow glistening varnish, as though some painter had let fall a brush dipped in yellow varnish upon them. It appears difficult to account for these varieties, and their occurrence must be rather considered interesting than important.

In every instance the shell is more or less pervious to air. In some of the instances detailed, this property appears possessed in a higher degree than in others; but in all, the shell, however apparently hard and compact, presents but little difficulty to the ingress or egress of air through

its pores; in the denser eggs, the process merely occupying a longer period than in those of a more open texture. That the shell is thus porous may be ascertained by the simplest experiment. If an egg is boiled in an infusion of madder-root, it will, after a little time, on being taken out, be found to have become deeply dyed with the colour of the fluid in which it was immersed; and this may even penetrate into the white of the egg, staining it in a singular manner. In the north it is a common custom to boil eggs in this way for amusement, at particular seasons of the year; and on the shell being removed, the white, which is rendered as hard as it is capable of becoming by means of long boiling, is seen tinged with the reddish hue of the liquid. By a little ingenuity, patterns of various kinds may be painted on the shell, the process consisting in enveloping it in a printed piece of calico, the colours of which are not fast, and then boiling. After a while the egg is taken out, and appears in a habit very unlike that of nature.

It appears that this custom of staining eggs is of very ancient origin. In Roman Catholic countries it appears to have originated in the practice

of making presents of eggs at Easter. The allusion evidently intended in this practice, was to the Resurrection. In process of time the custom of making these egg presents, led to the adornment of the eggs in a most extraordinary manner. The egg was sawn open with a fine instrument, in the direction of its long diameter; the shells are then



cleaned and dried, and lined with gilded paper; externally they are adorned with figures of various kinds. By a little dexterity, holes were made at

the edges, so as to provide for a hinge, and in this manner, the egg-shells were converted into boxes, which opened and shut at pleasure. The cut represents some of these singularly ornamented eggs. In Venice it was the custom to present these eggs to ladies by young noblemen, who would go to a great expense in having their portraits painted on the shells. In Germany they ornament eggs in a still more ingenious manner. Protecting certain parts of the shell by wax, or in other ways, they exposed them to the chemical action of dilute nitric acid; the acid would, of course, act upon the lime of the shell, and remove it, so that all the parts not protected from its influence, would exhibit an engraved character, the protected parts being plain.

In an old MS., in the collection at the British Museum, we have seen beautiful drawings of these eggs, some of which are represented in the cut. Evidently they were works of high art, being gilded and painted with great skill and ingenuity. In the same MS. are representations of a simpler class of decorated eggs, which were taken from some eggs painted by a convent of Italian nuns. These eggs are painted with various emblems, and

in very rich combinations of colours. On Easter day it was a custom among the Roman Catholics



to carry these pretty eggs to the priests to church; there they were blessed and sprinkled with holy water; after this they were taken home. "On that day, at dinner, the cloth is adorned with sweet herbs and flowers, and the first thing that is eaten are these blessed eggs, which are painted by the nuns of Amelia, a small city about thirty miles from Rome. The common sort of these eggs are all of one colour, as yellow, blue, red, or purple, which are sold in the streets till Ascension-day, or Whitsuntide."

In proof that this simple experiment of writing upon eggs may sometimes be turned to dangerous account, the following anecdote may be told. In the month of August 1808, an egg was found upon the altar of the Patriarchal church at Lisbon, bearing upon its shell the sentence of death of all the French, although there did not appear to be traces of the writing being the production of the hand of man. This apparent miracle caused much anxious excitement among the Portuguese, until the French distributed throughout the town, and had placed in all the churches, an immense number of eggs, upon the shells of which the contradiction of this lie was written. At the same time proclamations were everywhere posted up, explaining the secret of the supposed miracle, which consisted in writing upon the shell, when covered with an oily substance, and then plunging and retaining the egg for some time in an acid.

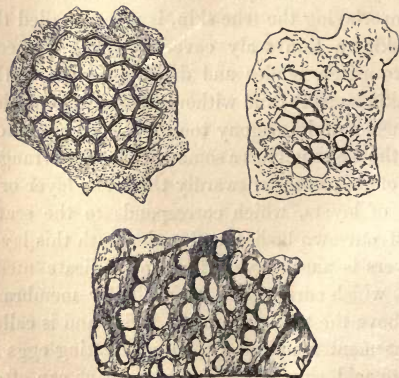
Until of late the structure of the egg-shell had attracted but little notice, and it was generally considered to be very simple; the hard calcareous part was thought to be simply a precipitate of chemical substances, in some instances apparently crystalline, in others not so, the particles of which

were connected together by mucus. But the inquiries of Dr. Dickie* appear to show that the egg-shell is much more highly organized than had been supposed—that it is really a very beautifully formed and even complicated structure. From his inquiries it appears that the shell has the same general arrangement of parts as the skin, or the mucous membrane lining the internal surface of the body. To most persons it is a familiar fact that, overlaying the true skin, is what is called the scarf-skin, a thin scaly covering which protects the exquisitely tender and delicate surface of the true skin beneath, and without which the sensation of touch would be agony too great for endurance. Now the egg-shell has a somewhat similar arrangement of its parts; outwardly there is a layer or a series of layers, which corresponds to the scarf-skin of our own bodies, and underneath this layer or layers is another very fine and delicate membrane, which corresponds to a similar membrane just above the true skin in the body, and is called the basement membrane. By macerating eggs in a dilute acid, shreds of a fine membrane can often be detached, which, when examined under the

* Annals of Natural History.

microscope, are seen to be full of small cells; this is the surface membrane, and underneath it, were we sufficiently expert in microscopic manipulation, we might detect the finer membranous structure, called, in the language of physiology, by the name of the basement membrane.

The superficial membrane varies very much in different eggs, and its variation is the cause, in



many cases, of the difference in the appearance of the eggs. Its appearance in the shells of the

ostrich, emu, and mimel thrush, is shown in the adjoining cut. It is in this tissue that the chalky deposit, which gives hardness to the shell, is placed ; the calcareous matter, when first deposited on the egg previous to its expulsion, has a crystalline aspect, being composed of many sided pieces. These however subsequently unite together. The engraving represents this feature in the structure of the shell.



It may appear trivial to enter into these minute particulars upon the structure of the egg-shell ; in reality, however, it is not so. No fact is too trifling to command our attention, if the knowledge of it will render our general information about birds more definite and complete. The knowledge, also, of the true structure of the egg-shell, is the only means of attaining any precise and satisfactory information as to the nature and seat of colour in the egg-shell.

The chemical composition of the shell has been carefully inquired into. That it contains lime was known to the older philosophers, who, with

the oddest sort of taste, used to employ it in preference to common chalk. The shell cleared from its living membrane, used to be boiled and sometimes calcined, after which it was laboriously reduced to the finest powder, and taken in suitable doses. With the same view, and apparently possessed with the idea that the mere singularity of a remedy would ensure its successful operation, powdered crabs' eyes, and the shells of fish, were used largely in medicines. As an item in the pharmacopœia it need scarcely be said that egg-shells are now entirely wanting; the white and the yolk, however, remain, and prove valuable for certain medicinal purposes. The composition of the egg-shell has been thus represented by Vauquelin:—

Carbonate of lime	96½
Animal matter	2
Phosphate of Lime and Magnesia	1
Carbonate of Magnesia	½
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	100
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It is very probable, however, that these proportions vary with the health of the animal, and with other circumstances of which we remain ignorant. Still, the broad outline of the chemical composition of the shell will remain much the same. It is not

difficult for the reader to satisfy himself as to the existence of animal matter and of lime in the shell. If the shell is heated in the flame of a spirit lamp it cracks and turns black, an effect due to the decarbonization of its animal constituents. A peculiar smell is at the same time emitted, which is the odour common to such matters when undergoing combustion. The presence of lime may be determined by dissolving the egg-shell in dilute hydrochloric acid. If this solution is then poured into a large quantity of water, and a few drops of a solution of oxalic acid are dropped into it, the white precipitate which immediately falls is oxalate of lime.

Sometimes eggs are laid without shells. Mr. Jesse says, "If the leg of a pullet is broken after she has laid two or three eggs, we find that as long as there is necessity for the formation of a new bone, she will perhaps drop one without a shell, and then cease altogether from laying any more till the bones of her leg are knit, and the union is complete. From this it is clear that a certain quantity of some material, lime and chalk probably, is necessary to enable a hen to produce a perfect egg." The lime in the case of the broken bone was taken by the blood vessels to repair that

injury, so that the egg was left without lime. In the poultry yard, where the management of fowls is not understood, this frequently occurs. In the *Lancet* for 1846, a statement is made by a person who kept poultry in London, that he had a hen which constantly deposited her eggs without a shell. This was due, without a doubt, to the bird's confinement, and to its not obtaining access to chalk or lime. Frequently pigeons will peck the mortar from houses, feeling the importance of the lime it contains as a part of their food. Hens will often eat egg-shells with the same view. In the instances of the deposition of shell-less eggs generally, the natural remedy is simply to give the birds a sufficient supply of chalk or lime in other forms.

It may be convenient to add in this place the chemical characters of the other parts of the egg—the white or albumen, and the yolk. If we suppose a newlaid egg to weigh one thousand grains, which is more than the correct weight, the proportion of its various parts to one another is as follows:—

Shell	106.9
Albumen	604.2
Yolk	288.9
	<hr/>
	1000.0
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The composition of the albumen, or white, and that of the yolk, are represented by Dr. Prout, in the following table, which exhibits a mean result:—

	Sulphuric Acid.	Phosphoric Acid.	Chlorine.	Potash, Soda, and Carbon, of ditto.	Lime, Mag- nesia, and Carbon, of ditto.
	Grains.	Grains.	Grains.	Grains.	Grains.
Albumen . . .	.18	.48	.87	2.72	.32
Yolk . . . . .	.19	4.00	.44	.51	.67
Total . .	.37	4.48	1.31	3.23	.99

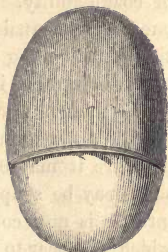
The most recent analysis is that of Professor Mulder. It differs little as to the mineral ingredients of the egg; the yolk, however, is looked upon by him as a peculiar chemical compound of sulphur, and a substance called *Proteine*, united with fatty matter and water. The large quantity of phosphorus present in this part of the egg has doubtless some important reference to the future body of the infant bird.

As the young chick becomes developed in the egg, the chemical principles undergo important changes. The phosphorus just alluded to, in conjunction with lime, goes to form part of the

bony skeleton of the bird, and various alterations take place in the composition of the yolk and white of the egg. But what appears inexplicable is the assertion of Dr. Prout, that the lime which forms the skeleton of the chick, forming in fact the earthy matter which communicates rigidity to the bones, did not exist previously in the egg, and as he believes was not, therefore, derived from the shell. If this assertion were correct, the circumstance would tend to upset all the ideas of chemists as to the nature of elements. But it appears probable that the statement is based upon inaccurate data.

The structure of the rest of the egg must now engage our attention. The white of the egg is enveloped, in addition to the double membrane next the shell, in a delicate membrane proper to it; a layer of this membrane passing across the broad end of the shell, at a little distance from it, forms the air receptacle exhibited in the preceding diagram. This lining membrane can be prettily shown in the following manner. By employing a very sharp three-cornered file, and acting on the shell with it at a distance of about an inch from the smaller end, the egg may be opened without

being broken. If then, with a pen-knife, a hole is made at the larger end, and the mouth be applied to it so as to blow into the egg, the lining membrane can be blown quite out of the egg-shell, as is exhibited in the accompanying cut, taken from a drawing by Mr. Towne. The white part or glaire of the egg is said to be divided into honeycomb-like cells, but they are not visible to the naked eye. It is divided into three parts, which all differ in point of density. The thinnest part of the white is next the shell, a denser part proceeding from without inwards is then met with, which is the middle portion ; and surrounding the yolk is a third part, which is called the most dense or tertiary layer.



The white of eggs presents some singular and indeed altogether characteristic properties. It is specifically heavier than water, and has a peculiar glairy consistence, which is familiar to every one. It is on this account largely used by bookbinders as a varnish, and for glazing various articles, form-

ing a part of the glaze in cards, and paper of some kinds. But its more characteristic property is that of coagulability. With this phenomenon every one who is acquainted with the every day operation of the boiling of eggs is already familiar. The egg, when placed in the boiling water, has entirely fluid, though viscid contents. After an exposure of a few minutes to water of this high temperature it may be taken out a solid mass; the shell may be stripped from it, and the once fluid interior is now converted into a dense substance, which will bear to be tossed about like a ball, and is often in fact so employed, without its integrity being broken. When it is remembered that nothing in the shape of a chemical ingredient has been added to it, and this remarkable change is solely due to the influence of heat, and that not of a higher degree than 212° , coagulation in fact taking place at a little above 160° , this phenomenon must be considered as one of great singularity and interest, and not the less so that it occurs a thousand times under our domestic observation. The addition of several chemical substances will produce the same effect. It is on this account very usefully employed in cases of

accidental poisoning by various irritant substances; such as corrosive sublimate: coagulation immediately takes place around the particles of the poison, which are thus effectually sheathed from the power of producing further mischief, until by the operation of an emetic, or by the employment of the pump, the dangerous substances are removed from the stomach. In consequence of the specific gravity of the albumen or white, with the yolk which it envelops, a fresh egg invariably sinks when placed in pure water. If, however, the water is rendered saline, and particularly if it is made a saturated solution, the egg will then float in it. An egg, not new laid, will often float in water, in consequence of the enlargement of the air-chamber at the broad end, produced by the loss of some of the watery contents of the egg by evaporation. In putting an egg into boiling water it will be noticed that a profusion of air bubbles rise from it, which are expelled from the shell, and perhaps in part from this air-chamber.

The air-receptacle has been frequently mentioned as being placed at the broader extremity of the egg. The best method of seeing it is to take

the broad half of an egg-shell which has been broken open for domestic use, and then, in looking at the inside, the partition membrane will be seen, and may be lifted on the point of a pen-knife; the little cavity beneath is then rendered distinct.

It is difficult to state what is the precise use of this air-chamber. It was formerly, and may be still by some, regarded as essentially necessary for the respiration, so to speak, of the developing bird. But some experiments, to which allusion will again be made, appear to show that such cannot be its real office. As the bird in the shell undergoes its early developments, this air-chamber increases in size;—it increases also if the egg is not in progress of hatching, and from a cause to which we have before alluded.

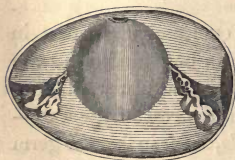
The lining membrane of the shell has been described to consist of two layers. In order to ascertain this, more skill in anatomical investigation is requisite than most persons possess, and under those circumstances they must be content to take the statement on the good authority with which it can be offered for acceptance. In the fresh egg this membrane is thin, semi-transparent, and very easily torn; but during hatching it be-

comes thicker and thicker, until it becomes almost like a layer of dense white parchment.

The last and most important part of the structure of an egg remains for our examination. The yolk is a thin yellow fluid, suspended in the white, and prevented from mingling with it by a membrane which is called very appropriately the yolk-bag. It is described as being deposited in very delicate membranous cells, having a honey-comb arrangement. In shape, as every one knows, the yolk is globular, almost spherical. Its position in the egg can be pleasingly shown by cutting a hard-boiled egg in half; the parts being all solid, this is easily effected by means of a very sharp and thin knife.

On the surface of the egg, and uppermost in every position in which it can be placed, is a little spot which, from its roundness, can always be seen to be clearly distinct from the rest of the egg—which is called the *cicatricula*, and is in fact the germ of life in the egg. It is the point from which the future bird is developed, and is slightly elevated above the rest of the yolk. Into the minuter structure of the yolk it is not here necessary for us to enter. But it is highly interesting to inquire

by what arrangement it is effected that the point of life in the yolk is always kept uppermost, and so nearest the fostering warmth of the parent's heart. If we open a fresh egg, and turn it about in every direction that is possible, so as to avoid spilling its contents, it will invariably be found that this life-point is at the top, so that no position of the shell likely to occur in nature can cause its place to be reversed, the little golden circle being seen, however we may act with regard to the egg, to be in the best place it could occupy for the reception of vital warmth. There is no piece of human mechanism with which it can be compared. The accompanying diagram will furnish the best



explanation of this arrangement. It will be here seen that, attached to the sides of the yolk-bag, are two masses of substance, which consist, in reality, of thick-

ened albumen, and are called *chalazæ*. Their shape is somewhat pyramidal, and they are connected to the yolk-bag by a number of processes which attach them securely to its

sides. Thus in whatever direction the yolk may be turned by the egg, the upper part containing the germ will always present itself at the top, the two chalazæ at each side weighing it down, and rendering it altogether impossible for it to be otherwise than rightly placed. These weights or chalazæ are attached at each end of the egg to the delicate membrane lining its interior. That nearest the large end is the larger of the two. When we remember to what diversity of position a body of such a shape as an egg must always be exposed, and when we consider, also, the importance of the life-point in the egg being kept in the closest apposition, during the early hours of incubation, to the mother's breast, the wisdom displayed in this simple and beautiful arrangement will be made manifest. We shall have occasion to notice, in a future page, the ingenious application of the knowledge of this fact in the structure of the egg, in the process of artificial incubation.

A few general particulars concerning eggs may be added. The specific gravity of new-laid eggs varies from 1,080 to 1,090; but on being kept, a part of their watery contents evaporates, and the

specific gravity of the white and yolk is thereby increased. An egg is continually losing weight after it is laid. An egg which weighed on a certain day in May, 907 grains, two years afterwards on the same day only weighed 363 grains, having lost in that time by evaporation 544 grains. When this egg was broken, its whole contents were found collected at the small end in a solid state, and on being put into water they absorbed a large portion of that fluid, and assumed an appearance not much unlike that of a fresh egg. The most curious fact, however, was that the egg was still fresh. When an egg is boiled in water it always loses weight, particularly if it be removed from the water while boiling, and cooled in the open air. The water in which it has been boiled will be found to contain a portion of the saline contents of the egg. The loss of weight from boiling varies, according to Dr. Prout, from 20 to 30 grains, supposing the original weight of the egg to have been 1,000 grains. This loss, however, is not due to the amount of saline matter dissolved by the water, which is very trifling.

A very interesting though little understood part of our present subject is that which refers to

the anomalous structure of eggs. In a state of nature eggs are much more regular in their size and other characters than in a state of domestication. Whether the cause be an increased abundance of food, or some other circumstance, cannot be determined; but it is certain that man exerts an extraordinary influence upon the creatures which he retains about his dwelling. In the flower-garden this influence is most remarkable, many of our flowers being never seen in their present condition in a state of nature. Over animals, too, the same influence, though to a smaller extent, is exerted; and in the case of the common hen, which sometimes produces regular eggs, we are justified in supposing that it is partly due to the same influence, although we are unable to explain its precise mode of operation.

The hen occasionally produces some most whimsically-formed eggs. A correspondent of the Magazine of Natural History describes one which fell under his notice, which weighed 1425 grains, and was as uncouth in shape as it was extraordinary in point of size. The shell was divided into three compartments or swellings, and contained three yolks. It was upwards of three

inches in length and about one and three-quarters in breadth; the two ends were of the same shape. The hen not unfrequently lays a double-yolked egg, and sometimes eggs without any yolks at all. Sometimes also, as has already been remarked, eggs are laid without the shell, and in all such instances are enveloped in a membrane like fine vellum.

The pheasant, which is almost as much under the influence of domestication as the barn-door fowl, although it pleases our sportsmen to consider it a wild bird,—frequently lays eggs as remarkable as those of the hen. Mr. Hewitson possesses some very remarkable deformities of this kind; one in particular is very singular in its appearance. It is cylindrical in shape, about two inches and a half long, and an inch and a half in diameter. Occasionally, eggs of this bird are found with a division across the middle. One of these is described as having given birth to a young bird, while the other half was found, on the division being broken through, to contain an entire egg of a globular form, having a very hard shell, but containing, as usual, white and yolk.

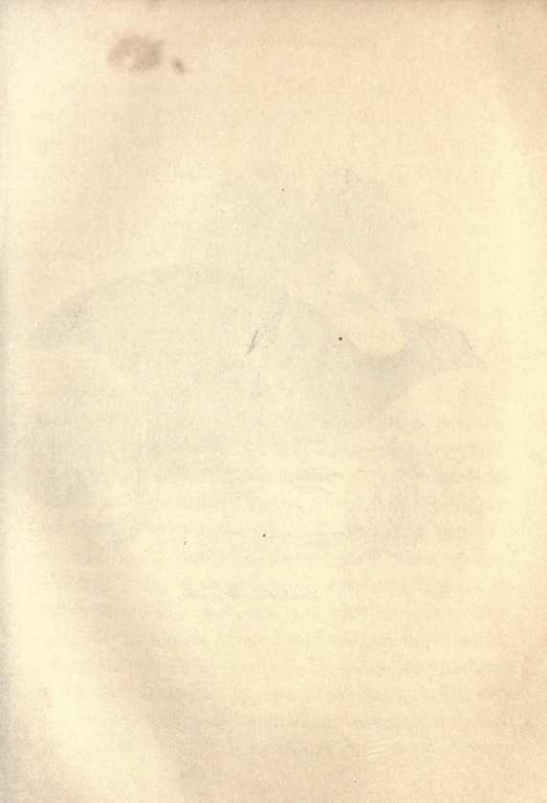
Among other eccentric varieties of eggs is the

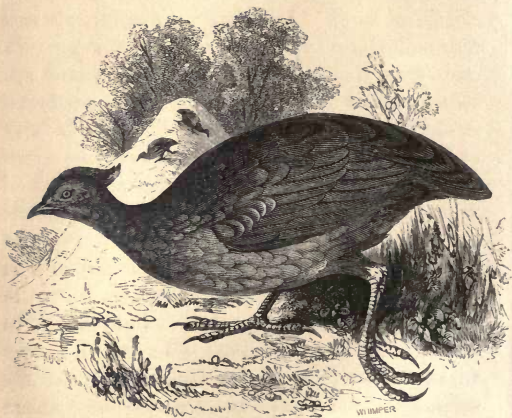
double-shelled egg. This kind of egg, though not very frequently met with, yet occasionally occurs, to the surprise of its discoverer. It is in reality an egg with two shells. The egg of a goose particularly large, is described in the second volume of the Magazine of Natural History as having this structure. Within the outer calcareous case was found another egg, resembling the outer one in shape, &c. but provided with a shell of its own.

The Inverness Courier contains an account of an abnormal egg still more remarkable than any previously noticed. This egg was considerably larger than ordinary, and was dropped by a duck. The egg having excited some curiosity, was cautiously broken open, and was found to contain three yolks, besides a small egg quite entire, and about the size of a pigeon's.

It is extremely difficult to account for the origin of these anomalies. Various explanations have been given, but none of them are of sufficient applicability to all the variations noticed to justify our adverting to them. It is sufficiently evident, however, that the malformation is due, in reality, to some interference with the natural processes, of the causes of which we are still ignorant.

Reviewing the various parts which combine to form the structure of the egg, how admirably do we find the provisions made for the well-being and security of the future bird! From its shape, the egg occupies the least room compatible with the form of its future tenant, while it is also rendered more secure against injury by the arched form of its shell. If it were given to man to form out of the same materials as compose the shell, a body as hard and firm in its structure as an egg-shell, he would altogether fail. The least quantity of material possible is employed, yet the shell is hard, unyielding, and will bear an extraordinary degree of gradual pressure without injury. Any sudden blow, however, cracks and destroys this beautiful case. The arrangement of the yolk and white, again, presents us with evidences of design and of consummate wisdom in its execution, inferior to none displayed in the natural world. Every part of the egg indicates it to be the work of a Divine Author; and in the next Part this will be rendered still more evident, as we trace the development of the spark of life within the shell, and the causes which lead to it.





Mound-raising Megapodius.

PART III.—INCUBATION.

CHAPTER I.

THOUGH we have yet to wait for the appearance of life in the shell, the action of incubation on the part of the parent bird is one which is of the greatest interest, and forms an important chapter in the life of a bird. The character of the bird at that time generally undergoes a very marked change. As if desirous of concentrating all its attention upon the task to which it is called, and as if feeling that new responsibilities are about to be entered upon, it quits its sportings over the meadows, and becomes a voluntary prisoner to the quiet and shady recesses in which its nest is placed. Few things in natural history

are more striking than this alteration in the habits and demeanour of the bird. When we remember the joy with which it delighted to wing its way through the air, the long period for which it would absent itself from its nest, for many hours in the day, and the distance to which, in its gambolings, or in its search after food, it would wander from its abode, and contrast its conduct in these respects with its demeanour now, we cannot fail to be struck with admiration and surprise. The poets have long selected the bird unrestrained in its airy wanderings as a symbol of freedom; yet we have now to watch this same winged being negligent of her liberty, and intent only upon the fulfilment of her duty of incubation. The desire is so strong that it might be called an instinct.

From the facts before stated with respect to the number of eggs laid by birds, the supposition seems to be in some degree warranted, that a bird will not incubate, or in other words sit upon its eggs, if interfered with, and the number kept from being increased by daily removal. The egg collectors on the coast state, that the guillemot would sit upon her single egg, if permitted to do so, and produce no more for that season; but upon its

being constantly taken away, the bird is always laying, and does not apply herself to the task of incubation for a time at least. The common hen, however, will sit upon only one egg, when the instinct of incubation comes strongly upon her. The Poland breed of hens have little or no desire to incubate, and their eggs are consequently put under other hens, in which this desire is uppermost for the time being. Hens will sometimes sit for weeks upon an empty nest. The turkey is also a good incubating bird, and will sit, says Mr. Jesse, for months together upon a very scanty supply of food. These are circumstances which the poultry-keeper pays much attention to.

In a wild state no bird will sit upon its nest when all the eggs are removed. Therefore, although the instinct of incubation, which effects so great a change in the habits of the female bird, is very strong, yet it is not, in a natural state at least, a blind instinct which would lead to the bird sitting upon its nest, when every possibility of the appearance of a brood of young to reward its patience was at an end. In such cases either the nest is abandoned, or the bird, instead of attempting to incubate, will lay a new set of eggs. It is

consequently reasonable to suppose, that the number, or, at any rate, the presence of the eggs in the nest, is necessary before the bird will begin to incubate.

Let us suppose, then, that all has gone on uninterruptedly, and that the nest contains its usual complement of eggs. Incubation begins; the female bird takes her station on the eggs, and, leaving her thoughtless companions to their amusements, becomes occupied in an extraordinary degree with the duties she has now engaged in. Her intentness while thus occupied has long been the subject of familiar remark. How often have we wandered through the orchard by the side of the tree in which the chaffinch has built its nest, and watched her escape in an instant on too familiar an approach! But this would be previous to the time of incubation. Then the circumstances would be greatly altered; the bird would be seen crouching close upon her eggs, and her maternal anxiety would almost permit the hand to be placed upon her back before she would attempt to escape, and on taking flight she would only seek a branch close by, where she would be joined by her twittering and anxious mate.

A number of pleasing anecdotes in illustration of the absorbing nature of this occupation are related by ornithologists. Mr. W. Thompson says, that a friend of his, discovering a robin-redbreast's nest, in which the bird was seated, remarked its apparent stupidity, and having lifted it off the eggs, and laid it on his open hand, it sought not, and indeed seemed to want the power to escape. He placed it in the nest again, and returning the next day found the young brood out. The appearance of the bird in its almost paralysed state on the previous day, it was now presumed had been caused by its extreme intentness in the last stage of incubation. Another interesting account referring to the same bird, was related to the Rev. Leonard Jenyns. This red-breast had built its nest in some ivy against a wall in a garden at Whitburn, near Sunderland. The bird was sitting upon four eggs, when the gardener one day trimmed the ivy so close with his shears as almost to destroy the nest. In consequence of this violence the eggs were precipitated to the ground. There they lay till they were observed by a lady, who shortly afterwards was attracted to the spot by the plaintive cries of the bird. It was at first

thought that to restore them to the nest would prove useless. The attempt however was made; and the eggs, which were nearly cold, were picked up and replaced in the nest, which was repaired and put together again as well as was possible. The eggs had not been restored to their former position five minutes before the bird came, and again took charge of them. In two days they were hatched, the infant brood being from that time of course objects of daily interest and observation.

The adventures of this poor bird's little progeny were not yet ended. Great was the dismay of their lady-protector, some days afterwards, at finding all the little ones upon the ground stiff and cold, having fallen through a fracture in the patched nest, which happened not to have been arranged in a manner sufficiently strong to keep them together. This lady took the little ones up, and with maternal sympathy for the bereaved parent, on perceiving a slight movement in one of them, she carried them into the house, where, partly by the warmth of the hand, and partly by the influence of a fire to which they were held, they all gradually recovered. They

were then again placed in the nest, which was further patched with a piece of drugget, fastened into the fracture through which they had fallen. They were doomed, however, to go through more trials. It happened some nights after that there was a heavy rain, which so completely soaked the nest, and the drugget which had been placed in it as a lining, that the young ones were found the following morning almost drowned, and to all appearance lifeless. They were again brought to the fire and thoroughly dried; after which they were placed in the empty nest of another bird, which was substituted for the old one, and placed in a currant bush, a few yards from the wall where the ivy was. The young ones, which were half fledged when they got this wetting, still continued to receive the attentions of their parents; and in due time they were all safely reared, and flew away. During this eventful part of their history it is stated that it was interesting and curious to observe the familiarity of the old birds, which always sat close by, and never appeared to be in the least alarmed at the liberties taken with their progeny.

The common partridge supplies us with a beau-

tiful example of maternal devotedness to the duty of incubation. One of these birds has been known to have been found sitting upon its eggs, and being taken by the labourer, to have made no attempt to escape, allowing herself and her eggs to be carried away in a hat to some distance. The eggs being then deposited in another place she continued to sit, and after a little time her patience and courage were rewarded by the appearance of a numerous offspring. In another instance, a partridge is described as having selected the top of an oak pollard for the situation of her nest. This tree had one end of the bars of a stile, where there was a footpath, fastened into it, and by the passengers going over the stile before she sat alone, she was disturbed and discovered. Yet even this dangerous proximity to human intercourse did not affect her; she continued to incubate the full period of twenty-one days; and ultimately hatched sixteen eggs. Her brood, scrambling down the short and rough boughs which grew out all round from the trunk of the tree, reached the ground in safety.

But two anecdotes related by Mr. Jesse are still more strongly indicative of the maternal love of

this bird for its eggs. A farmer discovered a partridge sitting on its eggs in a grass field. The bird allowed him to pass his hand frequently down its back without moving or showing any kind of fear. But if he offered to touch the eggs the poor bird immediately pecked at his hand. Her carelessness as to her own personal safety, and her devotion to that of her future progeny, are highly interesting traits in the character of this bird. The other instance is as follows: a gentleman living near Spilsby, in Lincolnshire, was one day riding over his farm, and superintending his ploughmen, who were ploughing a piece of fallow land. He saw a partridge glide off her nest so near the foot of one of his plough horses that he thought the eggs must be crushed. This, however, was not the case, but he found that the old bird was on the point of hatching, as several of the eggs were beginning to chip. He saw the old bird return to her nest the instant he left the spot. It was evident that the next round of the plough must bury the eggs and nest in the furrow. His surprise was great, when returning with the plough, he came to the spot and saw the nest indeed, but the eggs and bird were gone. An idea struck

him that the partridge must have removed her eggs; and, before he left the field, he had the gratification of finding her safely seated at the foot of a hedge upon twenty-one eggs, of which nineteen were successfully hatched: the round of ploughing had occupied about twenty minutes, in which time she, probably assisted by her mate, had removed the twenty-one eggs to a distance of forty yards.

Many of the aquatic birds exhibit the utmost attachment to the duties of incubation, and frequently become captives to their human foes in consequence. Mr. Hewitson informs us that, whilst incubating, the guillemot, which seems well to merit the name of foolish, will remain so stupidly seated, as to allow a noose at the end of a long stick to be passed round its neck. By this means immense numbers of them are taken by the inhabitants of St. Kilda, who subsist entirely on sea-birds. The same naturalist, who had the opportunity of observing the breeding places of the eider ducks on one of the islands in the Norwegian seas, found that this bird also sits intent upon her task. "On one island, which was strictly preserved, they were in great numbers, and hundreds

of male birds, beautiful in their pure black and white plumage, which were recklessly floating over a wide expanse of sea, added an indescribable interest to this otherwise desert scene. An old man, who had the care of the island, and seemed to derive much pleasure from the charge, accompanied us all over his premises, pointing out to us the ducks as they sat around us, apparently heedless of our near approach, and on quite familiar terms with our companion, who would even stroke them on the back, and was very jealous lest we should fire our guns, and thus scare his pets."

A beautiful instance of the same instinct of incubation, and of its power in rendering the parent bird apparently insensible to the emotion of fear, is recorded in the pages, old, but ever fresh, of Gilbert White of Selborne. In the centre of a grove there stood an oak which, though shapely and tall on the whole, bulged out into a large excrescence about the middle of the stem: in this a pair of ravens had fixed their residence for such a series of years, that the oak was distinguished by the title of the Raven-tree. Many were the attempts of the neighbouring youth to get at this eyrie: the difficulty whetted their

inclinations, and each was ambitious of surmounting the arduous task. But when they arrived at the swelling, it jutted out so in their way, and was so far beyond their grasp, that the most daring lads were awed, and acknowledged the undertaking to be too hazardous. So the ravens built on, nest upon nest in perfect security, till the fatal day arrived in which the wood was to be felled. It was in the month of February, when these birds usually sit. The saw was applied to the butt, the wedges were inserted into the opening, the woods echoed to the heavy blow of the beetle or mallet, the tree nodded to its fall, but still the bird sat on. At last, when it gave way, the bird was flung from her nest, and, though her parental affection deserved a better fate, was whipped down by the twigs, which brought her dead to the ground.

The female bird, it need scarcely be said, is the one upon whom, in the greatest number of cases, devolves this duty of incubation. During the period thus occupied, as we have before remarked, she is a close prisoner to the nest; but this statement requires some qualification. If her mate omits to supply her with food, she is compelled to leave the eggs for a short period in order to supply

herself; her excursions are, however, as brief as possible, and, the food obtained, she flies back to her absorbing occupation. It appears that in many cases the conduct of birds in this respect is much influenced by the state of the weather; if it is raining, blustering, and cold, we may be sure to find her at home, protecting her treasure from the injurious effects of such a state of the skies; if, however, it is clear, genial, and warm, the bird, which, in the former case, would only absent herself, when at all, for a few minutes, apparently sensible that exposure will not injure her eggs, frequently leaves them for an hour or more; the exercise, and food, and change, being both necessary and beneficial to herself.

An interesting account of the behaviour of a fly-catcher during incubation, narrated by a friend of Mr. Jesse, shows that birds are unquestionably, in some degree, observers of meteorological phenomena, although the temperature of the atmosphere in this instance was artificial. This bird had built its nest in his conservatory for several successive years. It was observed that it invariably quitted its eggs, whenever the thermometer was above 71° or 72°, and resumed her place upon the nest when

the thermometer fell again. Now, although the temperature of 71° or 72° of Fahrenheit's thermometer is not sufficiently great to favour the development of the germs in the eggs, yet the bird evidently perceived that the eggs would suffer no injury during her absence while the temperature was at this point, and seems to have availed herself of the opportunity to fly in search of food. Mr. Jesse continues: "This fact leads us to account for another respecting ostriches, which are observed by travellers to be absent from their eggs in the day-time, and to sit upon them at night. That they do this, is shown by the fact of the ostrich feathers being of less value during the period of incubation, than they are before or after; at that time they are tinged with red, which the Hottentots say is occasioned by their sitting on the red earth to hatch their eggs. I have this information from Mr. Burchall, who, however, says that he never saw an ostrich on the nest in the day-time." It is well known to poultry keepers that the common hen is absent for about half an hour each day from her eggs, without their receiving any injury. Sometimes, however, the nest is left for a still longer period.

“In the month of August,” writes Mr. Ord, “one of my domestic hens, after having been sitting about two weeks, forsook her nest. I perceived that she was afflicted with disease, and, on examining her, I found her cold and dying. She had been absent from the eggs for the principal part of the day, and as they did not exhibit the least external signs of heat I broke one, and found the embryo extremely feeble, so much so that scarcely any signs of life were visible; the remainder were removed to two sitting hens, and they all produced healthy chicks. One of my neighbours told me that he had known a sitting hen to be absent from the nest for a day and a night, and still the eggs hatched.”

During the period that the female bird is a prisoner to her nest, the male pays her the closest attention, in a number of instances; perching on a sprig close by, he will pour out such a succession of sweet notes from his little throat, that if his partner can be charmed with music, and if thus the weary hours of incubation may be wiled away, she has little to wish for in that respect. Some naturalists account, indeed, for the song of birds by this supposition, that it is intended for the

solace of the mother, while kept by duty from enjoying herself in the forest, or roaming with her companion whither she will; but unfortunately for this idea, birds sing when their partners have not begun, or have even long since concluded the cares of a parent. However, it can scarcely be questioned that the song of the male bird must be charming in the ears of his mate, though to ours, it seems in the case of the carrion crow and in others, rather unlike music, or pleasant sounds.

But the attentions of the male bird do not end with the mere display of his musical talents; he supplies his partner with something more substantial than notes. Leaving her for a little season, he disappears and plunges down to the oozy bed of the river, where aquatic larvæ of various kinds, and other food agreeable to his own palate, and to that of his mate, are to be found; or, darting high into the air, he may be seen wheeling in giddy flight after insects on the wing, and returning, faithful to his plight, supplies his mate with the fruits of his expedition. This continues until the time arrives which is to liberate the shell-imprisoned young, and at this time both parents engage in the office of catering for the family.

Sometimes, however, the male bird has to exert himself in the defence of his partner and their common treasure. Mr. Waterton supplies us with an account of a valiant bird, a misletoe-thrush, or stormcock, which showed its affection to its partner, and its resolution in her defence, in the most unequivocal manner. This bird had built its nest within a few yards of the place where some stone-masons were at work; a tame magpie had seized the female bird, and dragged her above to where the workmen were; the male bird, distressed at seeing his partner in this predicament, instantly came up, and fell upon the magpie with invincible fury. The magpie, resisting for a while, was at length compelled to let the fluttering prisoner go free; and both birds returned in triumph to the nest—only the poor female left half of her tail behind her, which she had lost in the fray.

Hitherto we have mentioned the female only as taking part in incubation; it is interesting, however, to find that in this parental duty the male in some instances relieves his partner, and takes his station in the nest. The blackcap-warbler is particularly remarked for his attention to this duty; this little bird seems even to delight in the occu-

pation which he undertakes. So much is this the case, that he is frequently known even to sing with great vigour while incubating, as though he would show himself to be as happy as possible, or as if he would wile away the dull hours of the female's absence from his side. A writer in the Magazine of Natural History says he has several times been led to the discovery of a well-concealed nest, by the male singing while on the eggs. Generally, however, the male, being perhaps of rather a volatile spirit, and growing weary soon of a duty calling for so much patience as that of incubation, sits neither so steadily nor so long as the female : it is, however, to his credit, if we may so speak, that he relieves his partner at all ; and, doubtless, she is glad enough after a short freedom to resume her duties with her accustomed patience.

The raven, the incubation of whose eggs requires a period of twenty days, is also among those birds who are thus distinguished ; during this time the male bird lightens the labours of his partner by feeding her while on the nest with the choicest pickings he can collect, and, when she is weary, by taking her place upon the eggs. The common rook is another instance of domestic affec-

tion and attention : he, too, as abundantly feeds his mate during the time of incubation, and occasionally relieves her by taking her place upon the eggs. This is also the case with the ring-dove, whose cooing notes are among the sweetest of country sounds ; the male and female sit by turns while hatching, and, when the young are hatched, alternately feed them. Other species of the Columbidæ are remarkable for the same actions. Of the American crow, Audubon says, "both sexes incubate, and their parental care and attachment are not surpassed by those of any other bird."

It seems not improbable that the cause of this constant incubation may be in the risk of too long exposure of the eggs in such cold situations as are selected by these birds for their nests. It will be easily conceived how much exposed the eggs of a dove must be, placed as they are upon a shallow platform at the summit of a tall tree. Perhaps, therefore, the constant application of warmth is rendered necessary by this circumstance, in these instances. Yet, in the case of the warblers, the nest is well concealed, even more so than in that of other birds, so that a general rule cannot be made out from the facts before us.

Sometimes the male alone undertakes the task, and incubates by himself; this is, however, an exception to the ordinary rule. The following anecdote is related by Mr. Jesse, in illustration of this remark. "The only instance I have met with, in which the hen bird has not the chief care in hatching and bringing up the young, is in the case of the emu, at the farm belonging to the Zoological Society, near Kingston. A pair of these birds have now five young ones; the female, at different times, dropped nine eggs in various places in the pen in which she was confined; these were collected in one place by the male, who rolled them gently and carefully along with his beak; he then sat upon them himself, and continued to do so with the utmost assiduity for nine weeks, during which time the female never took his place, nor was he ever observed to leave the nest. When the young were hatched, he alone took charge of them, and has continued to do so ever since, the female not appearing to notice them in any way. On reading this anecdote, many persons would suppose that the female emu was not possessed of that natural affection for its young which other birds have. In order to rescue it from this supposition, I will men-

tion that a female emu belonging to the Duke of Devonshire, at Chiswick, lately laid some eggs, and, as there was no male bird, she collected them together herself, and sat upon them."

An instance of an attempt at incubation on the part of the male bird is naïvely related by the traveller Kalm, who was indebted for the account to an eye-witness of the transaction. A couple of birds built their nest in a stable belonging to the observer, and the female laid eggs in the nest, and was about to sit upon them. Some days after, the male was seen flying about the nest, sometimes sitting on a nail near it, and uttering a very plaintive note, which betrayed his uneasiness; on a nearer examination the female was found dead in her nest, from which she was removed, and her body was thrown away, and the male then went to sit upon the eggs; but, after being about two hours upon them, and perhaps finding the task a little too troublesome, he went out and returned the same afternoon with another partner, who sat upon the nest, and afterwards fed the young ones till they were able to provide for themselves.

It appears well ascertained that, occasionally,

instead of the eggs in one nest being those produced by the parent who incubates, a common nest is employed by more than one bird, for the deposition of its eggs; that of the ostrich is said to be not unfrequently filled with the eggs of one or two other birds besides those of the incubating bird. A somewhat analogous instance is related by Audubon of a sort of partnership in incubation. In his account of the laughing-gull, he states, that he once found a nest formed, as it were, of two, that is, two pairs had formed a nest of nearly double the ordinary size, and the two birds sat close to each other during rainy weather, but separately, each on its own three eggs. He observed that the males, as well as the females, thus concerned in this new sort of partnership, evinced as much mutual fondness as if they were brothers, which indeed they might have been.

The following account, given by Mr. Kirk, a resident in Tobago, upon the incubation of the *crotophaga*, furnishes a most remarkable instance of a "common" nest. In September 1843, his attention was drawn to a nest of this bird, by the ranger of Buccoo, an estate under his charge. He informed Mr. Kirk, that there was generally one

bird on the nest, but that they frequently came in great numbers perching around it, and were particularly noisy. He examined the nest to which his informant alluded; it was built upon a cocoa-nut-tree, about thirty feet from the ground, and the tree being about forty feet from the dwelling-house door, an excellent opportunity was thus afforded to watch their habits. The result was, that there never did appear to be more than one bird in the nest during the day, but on sundry occasions, especially mornings and afternoons, they came in flocks of from twenty to thirty, alighting on the tree, and crowding around the nest, making a considerable noise, on which it was observed that the occupier of the nest at the time quitted her place, but whether from fear, or in order to give place to others, could not be ascertained—most probably the former. Mr. Kirk never saw more than one bird sitting in the nest at a time, except during these turbulent visits, and then it was quite impossible to tell how many might have been in it. The branches of the cocoa-nut-palm spring from the stem in a cluster ascending at an angle of from 45° to 50° , forming very deep and irregular interstices between the branches, and in one of these the nest

in question was commenced; the interstice was then deep, and the nest not large, but contained five eggs, which seemed to be covered by one bird. Mr. Kirk was absent from that district for several weeks, and on his return he observed that the nest appeared much larger, and was told it contained four birds. He did not disturb them on that occasion, but on returning about ten days thereafter, a servant was sent up to examine the nest, which he reported to be empty. Mr. Kirk, not feeling quite satisfied with this report, ascended the tree himself, and brought down the nest entire. On the upper surface lay one rotten egg, partially concealed by the sticks, grasses, and leaves, of which the nest was composed; on removing another stratum of the same materials, with a larger proportion of leaves, seven eggs were discovered; and on repeating the search further, and after the removal of full four inches of leaves, first ten, and then four more eggs were discovered, making a total of twenty-two addled eggs after the young birds had taken flight.

From observations made on this and former occasions it appeared certain that the community added to the general stock of eggs, and also to the

building, much to the inconvenience and annoyance of the original architect, who seemed at first perfectly satisfied with her own fabrication. On other occasions, when the same species of birds were watched in another part of the same island, they seemed to lay and hatch their own eggs without any addition by the eggs of others. In the windward district of Tobago, where this ordinary method of incubation was seen, the savannahs and swamps abound with underwood, shrubs, and creepers; while in the leeward part, and especially about Buccoo, scarcely a shrub or a bush is to be seen. It might therefore be thought that probably necessity had driven them to the cocoa-nut palms; this however does not account for the birds having recourse to a common nest.

It is a curious fact, that, during the process of incubation, birds are in the habit of changing the situation of their eggs in the nest. It appears that, in some degree, this is necessary to the well-being of the chick, although it is not precisely ascertained what the object of the bird really is. It may be to equalize the warmth, and to ensure the eggs outside the others receiving the same degree of heat as those in the centre of the nest. In arti-

ficial incubation, it is considered an important item to change the position of the chick within the egg, by now and then turning or slightly moving the egg. Sometimes the eggs are arranged by the parent in a very regular manner in her nest. A correspondent of Mr. Yarrell's, in writing of the pied-flycatcher, which builds its nests in the holes of decayed oaks and pollard trees, relates the following account of the nest and its contents. "In the season of 1830, a pair had a nest in the identical hole where this species had been for four successive years. On the fourteenth of May, this nest contained eight eggs, arranged in the following manner; one lay at the bottom, and the remainder were all placed perpendicularly round the sides of the nest, with the smaller ends resting upon it, the effect of which was exceedingly beautiful." Mr. Gould states that an Australian bird places her eggs in a very peculiar manner, during the act of incubation, putting two on each side the breast where it is bare of feathers. It lays only four eggs. The eggs of the Dunlin are also curiously arranged.

The period of incubation varies considerably in different species of birds. The golden eagle

occupies about one month in the task; the majority of the smaller birds are from twelve to fourteen days. The swan occupies six weeks; the eider-duck, one month; and the guillemot and puffin, the same period. It appears that the aquatic birds occupy a longer period than others, as a general rule; which is explained by the fact that during this time the young chick is being perfected, so that immediately on being hatched it may be able to take care of itself, with less exercise of caution on the part of the mother. The chicks of the smaller birds are sooner hatched; but they are quite helpless when they leave the shell, and some time must elapse before they will be able to quit the nest. In the case of the aquatic birds, it is surprising to notice how early the young run about, and swim, and help themselves to food. Thus it is evident that, as a general rule, the period of incubation is determined by the habits of the future chick; and the more nearly it is required to be perfected previous to quitting the egg, the greater the duration of incubation, and *vice versâ*. There are exceptions, however, to this rule, as to most others.

CHAPTER II.

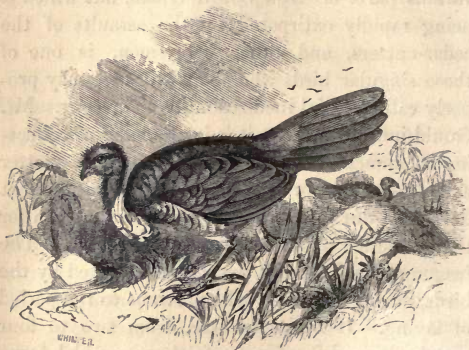
INCUBATION CONTINUED.

HITHERTO we have seen the process of *natural* incubation carried on by means of the natural warmth of the mother's breast alone. And this is the almost universal method in nature. But a most remarkable exception to the general rule has been discovered in Australian ornithology. It has already been noticed, that it appears probable in a few instances, and under the pressure of any extraordinary circumstances, that birds will for a time leave their nests, as if sensible that the external temperature was sufficient to carry on the process of incubation during the period of their temporary absence: the instances of the fly-catcher in the conservatory, and of the ostrich, illustrated this observation. We are now, however, to notice the proceedings of some birds who commit the whole business of incubation to external circumstances; adopting, however, a most ingenious

method of proceeding, and actually resorting to the employment of artificial heat in the process.

The wattled talegalla, a bird which is found in various parts of New South Wales, but which is being rapidly extirpated by the assaults of the cedar-cutters, and other sportsmen, is one of those singular birds who adopt what we may properly call artificial incubation for their eggs. Mr. Gould informs us, that it is in the habit of collecting an immense heap of decayed vegetable matter as a depository for its eggs, trusting to the heat developed during the process of decomposition for the perfecting of the incubation of its eggs. The heap employed for this purpose is collected by the birds during several weeks previous to the period of laying. It varies in size, from two to four cart-loads, and is of a perfectly pyramidal form. The construction of the mound is not the work of one pair of birds, but is effected by the united labours of several. The same site appears, from the great size and the entire decomposition of the lower part, to be resorted to for several years in succession, the birds adding a fresh supply of materials on each occasion previous to laying. The mode in which these mounds are raised is

singular; the bird never employs its bill, but grasping a quantity of materials in its foot, throws them backward to one common centre,



Wattled Talegalla.

thus clearing the surface of the ground for a considerable distance, so completely, that scarcely a leaf or a blade of grass is left. The heap being thus accumulated, and time allowed for a sufficient heat to be engendered, the eggs are deposited, not side by side, as is ordinarily the case, but planted at the distance of nine or twelve inches from each

other, and buried at nearly an arm's-depth perfectly upright, with the large end upwards. The eggs are covered up as they are laid, and allowed to remain until hatched. Mr. Gould was credibly informed, both by natives and settlers living near their haunts, that it is not an unusual event to obtain nearly a bushel of eggs at one time from a single heap ; and as they are delicious eating, they are eagerly sought after.

Some of the natives state that the females are constantly in the neighbourhood of the heap about the time the young are likely to be hatched, and frequently uncover and cover them up again, apparently for the purpose of assisting those that may have appeared. Others, however, state that such is not the case, the young being left to force their way out unassisted. From the fact of the egg being placed upright, Mr. Gould was disposed rather to credit the latter than the former statement, since the eggs of birds which are disturbed and turned during incubation are generally laid horizontally. At Sydney, Mr. Gould saw one of them in a state of domestication, which had for two successive years collected an immense mass of materials, so as to form a large mound in a garden.

The borders, lawn, and shrubbery, over which it was allowed to range, presented an appearance as if regularly swept, from the bird having scratched to a common centre everything that lay upon the surface. The mound in this case was about three feet and a half high, and ten feet over. On placing the arm in it, the temperature was found to be about 90° or 95° Fahrenheit. The bird itself was strutting about with a proud and majestic air, sometimes parading round the heap, at others perching on the top and displaying its brilliantly coloured neck and wattle to the greatest advantage.

The habits of the leipoa, another Australian species, are somewhat different, arising from the difference of the localities it inhabits, which are barren sandy plains in the interior of Western Australia. The eggs are deposited in a mound of sand, the formation of which is the work of both sexes. The natives say they scratch up the sand for many yards around, forming a mound of about three feet in height: the inside being composed of alternate layers of dried leaves and grasses, among which the eggs are deposited to the number of twelve and upwards, and covered up by the birds

as soon as laid, or, as the natives express it,—“ the countenances of the eggs are never seen.” The bird never sits upon the eggs ; but when she has laid her number, the whole are covered up, after which the mound of sand resembles an ant’s nest. The eggs are hatched by the heat of the sun’s rays, the vegetable lining of the hillock retaining sufficient warmth during the night. The eggs are deposited in layers, no two eggs being suffered to lie without a division : they are about the size of a fowl’s egg, and are white, very slightly tinged with red. The natives are exceedingly fond of them, and rob the mounds two or three times in a season. They judge of the probable number of eggs in the heap by the quantity of feathers lying around. If these are abundant, they know the hillock is full, when they immediately open it, and take the whole ; upon which the plundered bird will again commence laying, to be robbed a second time, and will frequently lay a third time. In these mounds ants are almost as numerous as in an ant-hill ; and it is said that, in some instances, that part of the mound surrounding the lower portion of the eggs becomes so hard, that it has been necessary to chip round the eggs with a

chisel before they could be extricated. The insides of the mounds were always hot.

Mr. Gould's accounts of these interesting birds yield, however, in singularity to those of his correspondent Mr. Gilbert, from whose notes we shall take the following extraordinary facts connected with the history of the Australian jungle fowl,—*Megapodius tumulus* of ornithologists. This bird is rather numerous spread over the whole of the Cobourg peninsula on the north coast of the Australian continent, where the British settlement of Port Essington is now established. On Mr. Gilbert's arrival at Port Essington, his attention was attracted to numerous immense mounds of earth which were pointed out to him by some would-be antiquarians among the residents as the tumuli of the Aborigines. The natives, however, who were not quite so learned, assured him that they were formed by the jungle fowl for the purpose of incubating its eggs. None of the antiquarians would, however, listen to this account of their origin, although they had never been at the pains to examine into their real character. Mr. Gilbert, being aware of the habits of the leipoa, just described, felt strongly disposed to take the

natives' view of the question as the more probable one, and under the guidance of a very intelligent native proceeded to a part of the harbour but little known, where a number of these birds were always to be seen. Landing beside a thicket, they had not proceeded far up the shore ere they came to a mound of sand and shells, with a slight mixture of black soil, the base resting on a sandy beach only a few feet above high-water mark. This mound was enveloped by trees, was of conical form, twenty feet in circumference at the base, and about five feet in height. On pointing it out to the native, and asking what it was, he replied, that it was a jungle fowl's house, or nest. Mr. Gilbert scrambled up the sides of it, and, to his extreme delight, found a young bird in a hole about two feet deep. It was lying on a few dry withered leaves, and appeared to be only a few days' old. The utmost care was taken of this young bird, which it was intended to rear, if possible. A moderately sized box was therefore procured, in which a large portion of sand was placed. It fed freely on bruised Indian corn, but it proved of so wild and intractable a disposition, that it would not reconcile itself to such close confinement, and

effected its escape on the third day. During the period that it remained in captivity, it was incessantly occupied in scratching up the sand into heaps, and the rapidity with which it threw the sand from one end of the box to the other was quite surprising for so young and small a bird. At night it was so restless, that sleep was impossible, in consequence of the noise it made in its endeavours to effect its escape. In scratching it only used one foot, and having grasped a handful, as it were, the sand was thrown behind it with but little apparent exertion, and without shifting its standing position on the other leg.

Mr. Gilbert continued to receive the eggs of this bird without an opportunity of seeing them taken out from the mound. At length the opportunity arrived, and he saw them taken from a depth of six feet in one of the largest mounds he had seen. In this instance the holes ran in an oblique direction downwards from the centre towards the outer slope of the hillock, so that although the eggs were six feet deep from the summit, they were only two or three feet from the side. The birds are said to lay but a single egg in each hole, and after the egg is deposited,

the earth is immediately thrown down lightly until the hole is filled up; the upper part of the mound is then smoothed and rounded over. It is easily known when a jungle fowl has been recently excavating, from the distinct impressions of its feet on the top and sides of the mound, and the earth being so lightly thrown over, that with a slender stick the direction of the hole is easily detected. The readiness or difficulty with which the stick can be thrust down indicates the length of time that may have elapsed since the bird's operations.

To reach the eggs requires no little perseverance and exertion. The natives dig them up with their hands alone, and only make sufficient room to admit their bodies, and to throw out the earth between their legs. By working with their fingers alone they are enabled to follow the direction of the hole with greater certainty, which will sometimes at a depth of several feet turn off abruptly at right angles, its direct course being obstructed by some mass of wood or other impediment. Sometimes their exertion is all in vain. In one instance a native dug down six times in succession to a depth of six feet without finding an egg,

and at the last came up in such a state of exhaustion that he refused to make the attempt again. He was induced, however, to do so, and the seventh time he came up triumphantly holding up an egg, and presently found another.

Mr. Gilbert describes one mound as of enormous proportions. It was fifteen feet in height, and sixty in circumference at the base, the upper part being a third less, and was entirely composed of the richest description of light vegetable mould. He and a native immediately set to work, and after an hour's extreme labour, rendered the more exhausting from the excessive heat and the tormenting attacks of myriads of musquitos and sand flies, an egg was procured from a depth of about five feet. It was in a perpendicular position, with the earth surrounding and very lightly touching it on all sides, and without any other material to impart warmth, which, in fact, did not appear necessary, the mound being quite warm to the hands. Like most of these mounds, it was so enveloped in thickly foliaged trees, as to preclude the possibility of the sun's rays reaching any part of it.

The mounds differ very much in their com-

position, form, and situation. Most of those that are placed near the water's edge were formed of sand and shells, without a vestige of any other material; but in some of them soil and decaying wood were found: when constructed of this loose material they are very irregular in outline, and often resemble a bank thrown up by a constant heavy surf. One remarkable specimen of this description, situated on the southern side of Knocker's Bay, has the appearance of a bank from twenty-five to thirty feet in length, with an average height of five feet. Another, even more singular, is situated at the head of the harbour, and is composed entirely of pebbly iron-stone, resembling a confused heap of sifted gravel. This mound is very extensive, and covers a space of at least a hundred and fifty feet in circumference. These remarkable instances would, however, seem to be exceptions; as by far the greatest number are formed entirely of light black vegetable soil, are of a conical form, and are situated in the densest thickets. Occasionally the mounds are met with in barren, rocky and sandy situations, where not a particle of soil similar to that of which they are composed occurs for miles around: how

the soil is procured in such situations appears unaccountable. It has been said that the parent birds bring it from a great distance; but this is scarcely probable. Mr. Gilbert conceives that they collect the dead leaves and other vegetable matter that may be at hand, and which in decomposing becomes converted into this particular description of soil. The mounds are doubtless the work of many years, and of many birds in succession. Some of them are evidently very ancient, trees being often seen growing from their sides. In one instance a young tree was found growing from the middle of a mound, which was a foot in diameter. It is difficult to understand how the young make their escape: some say they are assisted by the old birds, which scratch down and release them; others state that they escape unaided.

Only a single pair of birds are ever found on one mound at a time. The eggs are said to be deposited at night, and always in the perpendicular direction, and at intervals of several days. The bird is almost exclusively confined to the dense thickets immediately adjacent to the sea beach, and appears never to go far inland, except along the banks of creeks. By means of its powerful

claws it is able to scratch up roots from the ground with great ease. "The composition of the mound," says Mr. Gilbert, "appears to influence the colouring of a thin layer with which the eggs are covered, and which readily chips off, showing the true shell to be white. Those deposited in the black soil are always of a dark reddish-brown, while those from the sandy hillocks near the beach are of a dirty yellowish-white. The eggs differ a good deal in size, but are alike in form, both ends being equal. An average egg is three inches and a half long by two and a quarter broad." A representation of one of these eggs, taken from a specimen in the National collection, is represented on a previous page.

Artificial heat, as applied for the purposes of incubation, assumes more importance when considered as an application of human industry. The custom of hatching eggs by this method is one of high antiquity. The Egyptians have long been celebrated for the success which attended their plans of artificial incubation; and it appears to have been practised by them for many centuries. The art was long confined to a certain district in that country, where it was best understood, and

most successfully carried on. It was kept a great secret, not only from strangers, but even from the residents in other parts of the same country. The buildings in which this process was carried on were open to the inspection of observers; but the secret lay in the regulation of their temperature, a point, the ignorance of which could only lead any experimenter on a similar method to certain failure. Their plan was as follows:—

An oven of bricks was constructed about nine feet high. The middle is formed into a gallery about three feet wide and eight feet high, extending from one end of the building to the other. This gallery forms the entrance to the oven, and commands its whole extent, facilitating the various operations indispensable for keeping the eggs at a proper degree of warmth. On each side of this gallery there is a double row of rooms, every room on the ground-floor having one over it of precisely the same dimensions. These have a round hole for an entrance of about a foot and a half in diameter, wide enough for a man to creep through; and into each are put four or five thousand eggs. The building is adapted for hatching from forty to eighty thousand eggs, which are laid upon a mat

or bed of flax, or other non-conducting material. In each of the upper rooms is a fire-place for heating the lower rooms, the heat being communicated through a large hole in the centre. This fire-place is a sort of gutter, two inches deep and six wide, in the edge of the floor, sometimes all round, but for the most part on only two of its sides. The smoke escapes through the holes into the galleries and thence into the air. The heat is continued for ten or twelve days, after which the fires are put out, as the building will now retain sufficient heat to carry on the process until the time has expired. One hundred millions of chickens are said to have been annually produced in Egypt. Two-thirds, however, only of the eggs given to the managers of these ovens were expected to be accounted for in their return of fowls hatched. If more were hatched they were the profit of the incubators. Réaumur says, "Egypt ought to be more proud of these ovens than of her pyramids." Certainly they represent to us the resources of the Egyptians in developing the means of human sustenance as infinitely greater than those of many nations professedly more civilized and advanced in the art of life.

Nevertheless, the loss of chickens was far too large by this method to make it one of successful adoption in many places ; and experimental trials, by various naturalists and others, have succeeded indeed in demonstrating the fact, that artificial incubation is possible, but they have failed to show it to be economical also. The zealous Réaumur, to whom natural history is so deeply indebted, pursued the most laborious series of experiments upon this subject, in the prosecution of which he almost lost the wonderful patience with which he was possessed. The results of his experience were published in a volume called *Art de faire Eclorre*, published at Paris in 1749. For a considerable period he experimented with the heat of fermenting vegetable matters. His ingenuity in the various contrivances he adopted to render success the more certain is highly amusing, and is abundantly illustrated by engravings, which have been more than once copied into English works. Ultimately he was, to a certain extent, successful ; and he describes in lively terms the emotion of his gardener and his son on being informed that the first chick had made its appearance ; after which many others were hatched. In some of his expe-

riments, however, he warmed his eggs a little too much, and actually cooked them so that they were fit for the table!* The principal difficulty in attempting to introduce the Egyptian method, or any modification of it, into France, arises from the greater variability of the climate; that of Egypt, during the period when artificial incubation is carried on, being remarkably uniform and favourable to the process.

A singular anecdote is related by Réaumur, illustrative of the early history of his attempts at artificial incubation, which we shall give as nearly as possible in his own words. He had been turning this favourite subject over in his mind, and considering various sources of artificial heat, when he bethought himself of the great oven of a monastery not far off: "Madame Rosignol, the abbess, honours me," says Réaumur, "with her friendship. As I know her good-nature, I know also, that it would be a very pleasing proposition

* It appears that to Réaumur we are indebted for the simple but valuable discovery, that by smearing the surface of the egg-shell with any unctuous substance, it may be preserved fit for use as an article of diet for a much greater length of time than it would otherwise have remained.

to her, if I should offer her the means of having chickens in plenty, and of procuring some for the society. Her baking-oven seemed very fit for the hatching of chickens, and I happened to be at hand to make it serve to warm a chicken-stove; the monastery being near my house, and the oven being in a poultry-yard, which makes it still more convenient." Arrangements having been made for the accommodation of a large number of eggs, a tray containing a hundred was put into the proper receptacle. "The charge of keeping them in an equal heat of about 32 degrees (Réaumur), was given to a very ingenious nun, who was sincerely desirous to execute her commission well. However, a first experiment happens so seldom to have complete success, that I thought it very extraordinary, that out of a hundred eggs she had taken care of, above half of which proved to be unfruitful ones, there should have been twenty chickens hatched one day sooner than they would have been under a hen. When the first of them appeared, the nun to whom they were committed and owed their life, was transported with a pleasure that she could not contain; she directly ran to tell this interesting piece of news among all the nuns,

and in every other part of the convent where she might hope to meet with anybody. This transport, however, was a little abated, when she saw that part of the chickens which ought to have been hatched, had perished in their shells almost at the end of their time. This was evidently occasioned by their having been exposed to too great a heat. From this time the energetic nun became qualified to repeat much more successful trials, but the want of eggs and some other accidents, caused her to postpone to another time experiments that might have produced more chickens than the first."

For a time artificial incubation was even a fashionable pursuit at Paris. Réaumur read a paper detailing his experiments and their success, which was copied into various periodicals, and thus was the means of exciting a rage after this art in Paris, which extended even to the noblest persons in the land. Réaumur's gardener became as successful in hatching chickens as in forcing plants, and by the employment of the same means. "Nor," says Réaumur, "have my flower or kitchen-garden been the less cultivated for it." Noblemen, following Réaumur's directions, began hatching

chickens in every direction. The president's lady would needs be one of the first, and she desired that the experiment might be made immediately in her sight. A great princess followed her example; and both were gratified in rearing chickens out of a hot-bed of fermenting manure. Gradually, however, the fashion became obsolete, its novelty was lost, and, as regards its economical application, it proved a failure.

In 1840, the curious machine called the "eccaleobion," a word signifying "to call forth life," was exhibited in London. It was considered that in this contrivance all the difficulties of artificial incubation had been overcome, and that the result of its operation was perfectly successful. This machine was capable of containing two thousand eggs, and resembled an oblong box nine feet long, three broad, and the same in height. Its inventor asserted that it possessed a perfect and absolute command over temperature from 300 degrees of Fahrenheit, to that of cold water. So that any object submitted to its influence would be uniformly acted upon over its whole surface at any required intermediate degree within the above range. It was also said that the heat could be

maintained unaltered without trouble or difficulty for any length of time. And the somewhat confident inventor asserted, that by means of this absolute and complete command over the temperature obtained by this machine, the impregnated egg of any bird, not too stale, placed within its influence at the proper degree of warmth, is at the expiration of its natural time elicited into life, without the possibility of failure (!), which is sometimes the case with eggs subjected to the caprice of their natural parent. It is not stated in what way the temperature was obtained, but it may be confidently asserted that such a result as that just described is altogether incorrect. An air of mystery was pretended to be thrown over the machine with a view of enhancing its attractiveness; there can, however, be little question that it consisted simply of a charcoal stove with either hot water or steam pipes attached to it. In so far as it pretends to a success superior to that of the natural process, all statements respecting its operations must be considered as highly questionable. A large number of chickens were, however, hatched, it is said, by its means, which were ultimately successfully reared, as much so as if they had been hatched in

the ordinary way. The machine was shown in operation for a considerable period ; but failing at length to be regarded with interest, it was removed from the metropolis and forgotten. Artificial incubation thus experienced a second revival, and has been a second time consigned to oblivion. The inventor of the eccaleobion stated: "With respect to domestic poultry, the most nutritious of all human food, this rich provision of a bounteous Providence, the fecundity of gallinaceous birds, is for the first time available to all Europe." Such, however, has not appeared to be the case.

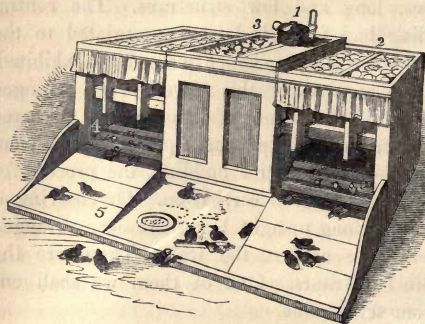
One of the most ingenious methods of artificial incubation practised of later years, is that which has been called by its inventor* Hydro-Incubation, the principal feature in which, the application of heat only to the upper surface of the egg, is called top-contact heat. As the writer of this little book paid a visit to the model farm erected by the inventor of this method of incubation, it may be interesting to describe the various steps adopted in this place for the artificial rearing of poultry. The site on which this model farm was arranged is in the neighbourhood of Chiswick,

* Mr. Cantelo.

and easily approached by the road from London. It consists of a long building with several out-houses, long and low structures. The central building had formerly been appropriated to the use of some giraffes, which were there exhibited. The other parts of this 'farm' were arranged specially for the benefit of its numerous feathered occupants. In an apartment petitioned off from the rest of the central building, the process for hatching the eggs is carried on. On entering it a series of long upright boxes are seen arranged side by side against the wall. These are the Hydro-Incubators. One of them we shall endeavour to describe.

It consists of an upright chest, divided into three compartments. In the central division the stove is placed, which is supplied with charcoal, and the temperature of which is carefully regulated. External to this stove is a perpendicular reservoir of water, which is heated by it. Pipes are connected with this reservoir to convey the water on each side of the chest into its two lateral compartments, and so to cause a constant circulation of the fluid. On each side is a space for the warm water at the top, the bottom of which is lined

with glass, or India-rubber cloth. The eggs are arranged in frames, and are applied to this under



The Hydro-Incubator.

1. Thermometer and Stove. 2. Egg-trays. 3. Receptacle for Young.
4. Artificial Mother. 5. Feeding Tray.

surface in such a manner, that, just as in nature, the first and chief application of heat is to the vital spot in the egg. At the lower part of the chest, at each side, the young chickens find a warm roosting place, by nestling under the warm water pipes which return the water in its circulation to the reservoir again.

The process of incubation carried on in these

ingenious machines is simple. The eggs are first, of course, selected with due care. An easy method of ascertaining their freshness, is by examining the size of the air receptacle at the large end ; this is done by means of a hole in the wall of a darkened room. On the broad end of an egg being placed against this aperture, the light which streams in through it reveals a certain black space corresponding to the air-receptacle within. It has already been said that the longer the period that has elapsed since the egg was laid, the larger this air-receptacle becomes. A simple means of ascertaining its comparative freshness is thus obtained. Our housewives are in the habit of getting similar information by holding the egg to the light, in such a manner as to show the size of the air-receptacle. The renowned M. Soyer says: "The safest way to try eggs is to hold them to the light, forming a focus with your hand ; should the shell be covered with small dark spots, they are very doubtful, and should be broken separately in a cup, and each egg smelt previously to using them. If, however, in looking at them, you see no transparency in the shells, you may be sure they are rotten, and only fit to be thrown away. The most

precise way is, to look at them by the light of a candle; if quite fresh, there are no spots upon the shells, and they have a brilliant light-yellow tint." This important point, more important in artificial incubation even than in culinary affairs, having been attended to, the eggs are placed in the incubator, and the process commences. The eggs are gently moved three times in the twenty-four hours, by which the slight displacement affected by the hen in leaving and returning to her nest is imitated. This action appears necessary, it is said, to obviate adhesion to the shell, and to permit of the minute blood-vessels ramifying with greater freedom over the surface of the egg; but on these points our information requires to be confirmed. The stove which supplies the machine with heat, contains a sufficient supply of fuel when fully charged to last the twenty-four hours. When once lighted it consequently requires but a small degree of attention. About mid-day daily, the eggs are taken out and cooled, for about twenty minutes. This is also in imitation of the hen, which is known to leave her nest every day in search of food for twenty minutes or half an hour. It is supposed that in this way a certain degree of aëration is

afforded to the egg, which it otherwise could not have obtained. Once a day it is necessary also slightly to damp the eggs with a soft sponge on the top only, as they lie in the tray; by this means their loss by evaporation is in some measure restored to them.

After three days of incubation a round spot or shadow may be seen at the top of the egg without removing the shell, if the process has been successful. This is the early development of the germ. As the time goes on, the germ enlarges, and ultimately fills the egg. Should some of the eggs placed in the incubator be addled, they are to be distinguished from the rest by, it is said, a ringing or hard sound, when moved with the others; while the good eggs sound very dull as if cracked. The suspected eggs are generally withdrawn, as they might prove injurious to the others. At the expiration of nineteen days and a half, the included chicks begin to peck at their shells. Thus, if a number of eggs were put in to incubate on a Thursday at five P.M., on the Wednesday morning previous to the expiration of three weeks, many shells would be found to be cracked, and some chickens would even begin to come out. Those which have not broken through

their shelly prison on the Thursday morning three weeks may be considered as good for nothing.

The chickens, as soon as hatched, are placed in a warm recess over the incubator, where they are allowed to remain until quite dry. This done, the process of incubation is completed. But the young birds would quickly perish if they were to be now removed from their wooden parent the incubator. They are so tender and delicate as still to require that degree of warmth which in nature is supplied to them by the mother, who gathers them under her wings. If, therefore, our incubation is to be carried to a completely successful issue, an artificial apparatus, which would take the place of the hen in this respect also, must be employed.

At the "model farm" a number of frames were placed on the grass, which resembled the glass frames used by horticulturists for their tenderer plants. On inspecting these they were found to contain the hen's representative in a very ingenious form, and to be full of a thriving little family of chickens. This arrangement out of doors is, however, a summer arrangement; in the winter it is taken in. By its means, although the chickens could get both air and exercise, and appeared to

enjoy the grass which they played amongst, yet they were unable to wander away, and so incur the risk of being lost or stolen. At the back of these frames was a charcoal stove, constructed on the same principles as that of the incubator, and surrounded, like it, by a reservoir of hot water. In connexion with the latter are a number of hot-water pipes, about an inch and a quarter in diameter, and about the same distance apart, which run horizontally along the back of the frame, resting on supports about five inches from the floor. Beneath these pipes, which represent the hen's breast and wings, is a sliding board, which is always at such a height as to allow the backs of the chickens to touch the pipes, and which is gradually lowered as they increase in size. Above these pipes a horizontal board projects, to the front of which a curtain is attached; by this means the chickens are protected in front from the cold, and are also prevented from leaping upon the warm pipes, which they are as fond of doing, if not prevented, as they are of clambering upon the back of their natural parent, the hen. The young chickens having been once placed beneath this artificial mother, become quite attached to it, and will only

leave it to eat or drink, or to take exercise, and will then return to it of their own accord.

As the chickens become older they no longer require the fostering warmth of the artificial mother, and are then turned out, if the weather is genial, into the poultry-yard. At night their wants are cared for still; and at Chiswick there is a long low building called the roosting house, fitted up for their accommodation. This building is warmed by hot water pipes, which maintain it at an equable temperature, and also obviate the dangers arising from damp or exposed roosting places.

It will be observed, that it has been the aim of every arrangement in this ingenious and successful system of artificial incubation, to imitate, as far as with wood and metal it is possible so to do, the circumstances under which chickens are reared by their natural parent. The rule taken has been, that we must not try to improve upon the operations of nature, but follow implicitly in her steps in all our attempts to imitate her wonderful operations; and the result appears to have demonstrated its wisdom. The leading feature of the whole is the application of warmth to that part of

the egg, to which the very construction of the egg seems to indicate that its quickening influence must be applied. In effecting this end the waterproof cloth with its warm contents, or the harder surface of glass, is the representative of the mother's breast; and by the construction of the machine the egg derives its first supply of heat exclusively from above, just as in nature, some time necessarily elapsing before the warmth is conducted to the lower part of the egg, and the warmest part being always at the top nearest the warm water. There can be no question that by this means a smaller amount of evaporation takes place from the egg, than would be the case under other circumstances, and particularly than is the case in other systems of artificial incubation in which the whole surface of the egg is exposed to the action of heat.

The temperature employed in the "top-contact" incubation is considerably higher than is usual in artificial incubation upon other plans. The temperature of the water is about 109° Fahrenheit, which ensures a temperature of about 106° to the surface of the eggs. This temperature has been found to be nearly that of the blood-heat of the

fowl. This is several degrees higher than the blood-heat point in man.

The produce of chickens hatched by this system is stated to be as follows. If the incubator is used the year round with a hundred eggs at each time, the average number of chickens will be seventy-five out of the hundred; and the hatching may be carried on eighteen times in the year; the annual produce therefore, from one of the smallest incubators, would be about thirteen hundred and fifty chickens. It is considered that on a large scale a fowl can be produced and reared upon this method until it is fit for table, at a total cost of from eight to ten pence. At the period of our visit to this hatching farm, a number of incubators were employed in the artificial rearing of the eggs of pheasants, partridges, and Guinea-fowl; which are said to be equally successfully managed with those of the common barn-door hen. It is said, that in some cases a larger number of eggs can be successfully hatched by this method, even than by the natural parent; the risk from disease, from violence, or from straying, being frequently very great when the bird has been the incubator.

Upon the small scale, and for the purpose of domestic experiment and instruction, we may be permitted to describe a little apparatus which we have frequently employed with success, and which can be made at any of the tinmen's shops. It consists of a double-case cylindrical tin vessel supported on three legs of tin. The hollow interior space is for the eggs; the bottom and sides should be double, filled with warm water, which is kept at a certain temperature, 100° to 105° , by a small spirit-lamp. At the top of one of the sides is a small hole, through which a thermometer is introduced into the water. The chamber for the eggs also requires a thermometer, which is introduced through a tube attached to the lid covering over this chamber. A small tube runs through the double bottom, and projects a little below it; the intention of which is, to admit air into the place for the eggs. A certain number of eggs, as fresh as can be obtained, are now placed in this receptacle, which is lined with cotton wool; and the lamp being lit, the lid on, and the thermometers duly regulated, incubation commences. It will be found at first very difficult to maintain an equable temperature; and there is a constant risk of destroying the young

chicks by excessive heat, or retarding their development by too low a temperature. Patience and the avoidance of disturbing the apparatus furnish the best remedy for this inconvenience. By a little careful management the process can be successfully conducted, and the development of the chick may be watched all through its interesting stages up to the perfection of its life in the shell.

CHAPTER III.

DEVELOPMENT OF THE EGG.

Meanwhile the tepid caves, and fens, and shores,
Their brood as numerous hatch, from the egg that soon
Bursting with kindly rupture forth disclosed
Their callow young.

WE now approach a highly interesting, but extremely difficult part of the life of a bird. In fact, the dawn and development of life in the shell is the most delightful part of its history in the eyes of the physiologist; and it is to be hoped that it will in some degree prove equally pleasing to the reader of this book. In the fact that birds, without an exception, are perpetuated in the world by means of eggs, and not by bringing forth their young alive, as is the case in the mammalia; that the eggs are carefully hidden from view generally, and, in a large number of instances, are placed in a beautiful receptacle prepared by the ingenuity of the bird for their reception,—we may see the evident intention of the Creator, that they should

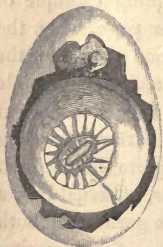
enjoy a degree of protection which is not vouchsafed to many members of the zoological kingdom. It has been well said by the eminent and pious naturalist Ray, "That birds should all lay eggs, and none bring forth live young, is a manifest argument of Divine Providence; designing thereby their preservation and security, that there might be the more plenty of them; and that neither the birds of prey, the serpent, nor the fowler, should straiten their generations too much." The eggs are, however, often a prey to birds and other enemies.

The little golden spot, called the cicatrix, is the seat of all the remarkable changes which are now to take place in the egg. When incubation actually commences, the parent bird "sits close," as it is said, upon the nest which now contains the complement of eggs peculiar to the species. The warmth thus communicated by the breast of the hen to the egg beneath her, penetrates the shell, and acts in a peculiar, and, to our limited perceptions, in a wholly inexplicable manner upon the germ. It will be remembered, that, in consequence of the peculiar arrangements already alluded to, this vital point in the egg is always floated upper-

most, and thus is presented in that position in which it earliest receives the quickening influences of the heat communicated by the hen. The greater number of eggs are consequently placed in the horizontal position. The shape of the egg makes this a matter of necessity; for every one is acquainted with the celebrated puzzle of Columbus, regarding the difficulty of setting an egg to remain in any other position. In the exceptional instances occasionally occurring, and a striking example of which was mentioned in a former page, when the egg is placed in some other position than this, the same result is not attainable; and it is possible that in such instances the early influence of heat is felt as much at any other part of the egg as at the part where the vital germ is situated. The general provision is, however, effectual in the greater number of cases, and the germ feels both first and in the highest degree the fostering warmth communicated to it by the hen.

The spark of life is awakened after the continuance of the necessary heat for a few hours. This may be very beautifully seen by means of the little artificial incubator already described; and many of the facts in the development of the

chick may be most pleasingly illustrated by a little careful manipulation. Care must, however, be taken to place only fresh-laid eggs in it—which in the metropolis it is not always easy to obtain. After a period of eight or ten hours a change in the appearance of the golden eye of the egg is discernible by help of a lens. This change consists in the appearance of a very delicate halo surrounding this little spot. This halo continues to enlarge,



and at the end of thirty-six hours it presents the singular and beautiful appearance shown in the cut. At this time the heart, that is to say, the pulsating spot which forms its earliest commencement, can be seen beating and propelling blood into the delicate vessels, which now run over the yolk.

Some hours afterwards the form of the head, the eyes, the beak, the spine, and several other parts of the future chick are discernible. About the third day rudiments of the wings and legs become visible. At the fourth, or fifth, all those parts are still more plainly discernible; and it is a beautiful

sight to watch the heart now beating, and propelling the clear red blood through the numerous translucent tubes which ramify over the surface of the yolk.

By exposing the egg at this period to the influence of cold, it will be seen that the beating of the heart ceases. It first becomes gradually slackened, until finally it ceases to beat altogether. But the life of the little being is not now necessarily destroyed, unless the cold applied is too severe. The whole of the phenomena may be reproduced, by simply putting the egg into warm water. In proportion as the heat rises, the little heart begins to act again, until when it has reached its former degree, its pulsations are as frequent as they were before. If the heat is raised to 115° or 120° , the heart will be seen to beat much quicker than before. On again applying cold the movements diminish in frequency, until they cease entirely. As may readily be imagined, the application of any corrosive acid, or poisonous chemical ingredient, soon puts a stop to the whole phenomena of life in the chick; and in this instance they cannot be renewed. These facts are important, since they show us that the temporary absence of the parent bird

during incubation is not necessarily fatal to the life of the chick. In fact, it would even appear that such variations in the temperature to which it is exposed are in reality favourable to the little being. Possibly after a temporary relaxation of vigour in the action of the organs of the little being, they renew their functions with the greater force and vivacity upon the return of the parent, on the reapplication of her fostering warmth to the surface of the egg. The application of too much heat acts, however, as injuriously as too much cold. Réaumur had a lively perception of the fatal effects upon the life of the chick by excessive heat; and this is abundantly manifest in his copious instructions to artificial incubators upon the subject of thermometers. His own words on this subject are so quaint that they deserve to be quoted.

“ Although it is very certain that our country pedlars will be very desirous to supply many of the villages with thermometers, yet a great many years may pass, and all the villages that might wish to have them may not be provided with them; especially those that are at a great distance from large towns; besides that, a

thousand accidents may occasion the loss of the thermometer that has been bought, and a moment's absence of mind is enough to cause so tender an instrument to be broken. I have, therefore, endeavoured to procure for the country people a thermometer that shall not have the air of a philosophical instrument, that may not surprise them by an appearance of something above their understandings, which they may make themselves, and which shall cost them nothing, or at the utmost, not more than a bit of butter not bigger than a nut and half as much tallow would cost them! Let them melt and mix together these two ingredients, and pour them into a common drinking glass (and that may as well be without a foot as with one), and this shall be their thermometer. If they can procure any of those small bottles that are usually filled with sugar-plums, and sold at fairs to children for a halfpenny, or a penny at most, bottle and all, they may make a still more convenient thermometer. After having taken the sugar-plums out of one of them, it must be filled only in part with the mixture of butter and tallow just mentioned; and this instrument, coarse as it is, will teach them whether the chicken-

oven has the right degree of heat, or whether it has too little of it. The heat of the oven will render the matter of the thermometer as fluid as oil when it is excessive, and it will be known to be too weak when it remains perfectly coagulated; it will have the requisite degree when the matter in the bottle has the consistence of a soft piece of dough; a small portion of which may happen to run when the glass or bottle is inclined, in the same manner as a syrup grown too thick would do." This instrument, simple and even ludicrous as it appears, does the philosopher, who could stoop to the necessities of his more ignorant and poorer countrymen, not less honour as a man of science, than credit as a man of benevolence. It is curious that a somewhat similar substance to that here employed by Réaumur for a rude thermometer, has been adopted in an ingenious instrument for giving warning in the event of fire in any particular apartment.

It is important to know, that a very small excess of heat is sufficient to destroy the life of the chick at this period. A number of experiments have shown, that if it is exposed to a temperature of 130° , or a little under, the life of the germ is

destroyed, the heart ceases to pulsate, nor can it be again quickened to movement. In nature, it need scarcely be said, there is no risk of such an event. The temperature of the bird does not exceed 106° ; and that of a climate, seldom or never reaches the degree named.

It is not considered, in a work of this kind, that it is expedient, or that it would prove interesting, to give a detailed account of the development of each organ in the chick up to the time when it quits the egg a perfect being;—perfect, that is to say, according to the degree of development natural to the species while in the egg. Physiologists have watched the phenomena in question with the most profound attention, and have described, with the most astonishing minuteness, the first appearance, the changes, and the gradual perfecting of the various parts of the chick in the egg. But such researches are little adapted for popular instruction; they often rather weary than inform the mind of the general reader; and we shall consequently rest satisfied with a bare account of a few general facts upon the subject. The minutiae are accessible in the various

English and German works on Physiology and Comparative Anatomy.

About the fifth day the lungs of the chick are discernible; but, of course, in a very rude and imperfect condition; and, as yet and for some time to come, not intended to perform any part in the respiration of the chick. The skin, and traces of the feathers, next appear, and the chick commences a curious but feeble motion. Then the bones begin to be formed at the joints, the muscles of the body are developed, the blood-vessels are well formed, the feathers appear, and so on, until two or three days previous to the time of hatching. Almost all the peculiarities of a young chick are presented by the being included within the shell at this period. In a day or two more the whole process is completed, and the chick is born into the world.

Various changes take place both in the white of the egg and in the yolk, during this period. The yolk becomes more fluid than usual. About the third or fourth day the white and the yolk become mingled together. The white then appears to pass into the yolk-bag, all but a dense thick portion which remains at the bottom of the shell.

At the expiration of the full period of incubation the white has entirely disappeared, leaving, as the only trace, a few dry flakes of membrane, and an earthy residuum. The yolk also disappears, being taken into the body of the chick. It might appear to the unthinking person, that the conversion of the fluid matters forming the egg, in its fresh state, into the solid and fleshy constituents of the chick, must be attended with increase of weight. It appears a natural supposition, that the egg containing a chick should weigh considerably more than it did at first. Such, however, is not the case in reality; the egg actually weighs less at the expiration of the period of incubation than it did at its commencement, having lost about one-sixth part of its entire weight during that time. This loss consists chiefly of the loss of water by evaporation from the surface of the egg-shell.

It may be naturally asked, What has been the exciting cause which has produced the wonderful phenomenon of the development of a living bird from an apparently lifeless spot, floating in the contents of the egg-shell? When we remember, that in artificial incubation, heat is the only agency employed to awaken life in the shell—is it to be

understood that it is heat which gives life to the little germ? Heat is equally necessary to kindle the spark of life in the death-like pupa state of the insect, or in the tiny germ contained within its egg. Nor is heat less essential to the quickening of life in the seed buried in the soil. Yet in neither of these instances can it be for a moment considered that heat is any thing more than a necessary condition. Heat gives not life to the germ. The life is in itself; but it cannot be developed without the requisite degree of heat for that purpose. In the case of plants, it appears that the chemical rays of sunlight are almost as essential as those of heat. As yet, we are not able to say the same with respect to eggs. But in every case, heat, or the actinic ray, or both combined, or electricity, or any other physical agencies, are not the cause of life. Life is the gift of God, whether to the seed or egg, and mysteriously lies dormant in the organized particles until favouring circumstances present themselves for its development. How mysterious this appears; and what a lesson of humility and reverence is impressed on the mind which perceives itself unable to comprehend the com-

monest operations of the great Creator in the world around!

As yet—that is, previous to the eighteenth day of incubation,—the chick does not use its lungs. It is unable to breathe. Yet it is well known to most persons that respiration is absolutely necessary to life in every condition, whether in its infancy or in its maturity. By the term respiration it is proper to understand, that change in the blood which is produced by its exposure to air—and not merely the act of inspiring and expelling a quantity of air from the lungs. Fish and aquatic insects respire, although they do not breathe the air we breathe; but in their cases the blood is exposed to air dissolved in the water in which they swim. It is to be inquired, therefore, whether respiration goes on in the chick during the first eighteen days of its existence within the shell. If we open the shell about the twelfth day, it has been described as exhibiting one of the most splendid spectacles that occurs in the whole organic creation. A multitude of blood-vessels are seen ramifying upon the surface of the membrane enveloping the chick, which convey blood to and from its body. It is generally considered by physiologists, that

this exquisite lace-work of blood-vessels is a simple but beautiful and perfect substitute for the lungs. The blood in these delicate tubes being brought near to the external wall of the egg, it is supposed that air passes in and out through the pores of the shell, and that thus the renewal of the blood is effected. Respiration is thus carried on until the nineteenth day of incubation, when the lungs are called into play.

The receptacle of air at the large end of the egg has been thought to serve a most important end in this process. Dr. Paris, in a paper published Vol. X. of the Linnæan Transactions, carefully analysed the air contained in this little sac. By perforating twenty-one fresh-laid eggs at the large ends, and collecting the gas in a jar—which amounted to a cubic inch,—he found it to be pure atmospheric air. Two eggs were opened after incubation had gone on for some days, which yielded an inch of air. On examination, some carbonic acid gas was found in this air. Other observers have also analysed the air contained in this receptacle. M. Bischoff found it to contain more oxygen than atmospheric air. M. Dulk arrived at the same conclusion, and found after incubation, that the quantity of

oxygen was reduced, and that a portion of carbonic acid was added to the air. From these experiments it has been argued that the chick respires some of the air contained in the air-follicle at the broad end of the egg.

Several curious experiments, some of them however remarkably contradictory in their results, have been performed upon the respiration of eggs. It has been said that if eggs are varnished over, or coated with oil, the chick will perish in consequence of the interruption to its respiration. In warm water also the development of the eggs of birds is not maintained, nor in gases which are irrespirable. M. Schwann found that when eggs were kept at the proper temperature in gases which contained no oxygen, a slight change in the germ takes place, but no blood is formed. Eggs confined in pure hydrogen gas, if kept at incubating heat for thirty hours, were killed altogether; for twenty-four hours they could still be developed if admitted to atmospheric air. Other observers state, however, that they have kept eggs in irrespirable gases without injury to the germ, and that it has been developed when kept at the proper temperature of incubation.

Some experiments have, however, been performed by Mr. Towne, which leave the whole matter in the greatest perplexity, and appear to upset all previous notions on the respiration of the chick in the shell. Mr. Towne's doubts on the subject of respiration through the medium of the blood-vessels and membrane before mentioned, which are for that purpose near the outer lining of the shell, were excited by finding that during incubation the lining membrane of the shell becomes very much thickened, until it assumes the appearance of parchment, thus presenting a considerable obstacle to the passage of air through it, instead of, as might have been expected, becoming thinner, or at any rate remaining unaltered, so as to afford no unnecessary obstruction to the passage of air through its pores. It appeared therefore unlikely that respiration could be carried on with the necessary freedom through this thickened membrane. It is deserving of remark, that in the experiments of varnishing the egg, performed by other observers, an innocuous varnish had not been employed, and consequently it was scarcely just to consider, in the experiments mentioned, that the death of the chick was solely attributable

to the process of respiration not going forward. In order to decide the point, Mr. Towne performed the following singular experiment.

Having selected a number of fresh eggs, as nearly as he could of the same size and form, he varnished them over many times with albumen, *i.e.* white of egg, which had been allowed to stand for some time in an open vessel until by evaporation it had acquired considerable consistence: this was repeated until the shells appeared completely lacquered. He then with a pencil marked one of them into equal sections, like the divisions in an orange, and cut a piece of card to correspond exactly with one of these divisions. Then a great number of papers similar to this card were cut and soaked for two days in albumen until they were thoroughly saturated and so soft and pulpy that they could be readily applied to the egg, and their edges brought so close together that the joining was scarcely observable. After having covered the eggs in this way, and allowed them to dry, the papering and varnishing were repeated four times, taking care to bring the middle of each section opposite the joining in the previous coating. They were now covered with four thicknesses of paper,

besides very numerous coatings of the white of egg varnish, first on the shell itself, and then on the several coats of paper, the whole forming a covering so thick and horny that it must have been actually impermeable.

These eggs were put under a sitting hen and were successively opened on the fourth, fifth, sixth, seventh, eighth, ninth, and tenth days, and the appearances were perfectly natural. The chicks had gone through all their changes without the smallest interruption! At the twelfth day, when the beautiful membrane with its blood-vessels—the so termed “beautiful substitute for the lungs”—is best developed, eggs thus densely covered were opened, and the chick was found perfectly healthy, and the membrane as exquisitely interlaced with arteries and veins as usual. One of the covered eggs was allowed to remain until the nineteenth day, yet on opening, the chick was found perfectly vigorous, and evinced strong disposition to escape from its shell.

A still more conclusive series of experiments were then commenced. After proceeding with the eggs as before, only super-adding an additional layer, making altogether five thicknesses of stout

paper, *three thick coats of oil-paint* were then added, the paint consisting of white-lead with a large proportion of sugar-of-lead; this was done with the double intention of offering an additional obstruction to the air, and also to prove whether the paper was or was not entirely sufficient for this purpose, concluding that if it were not, the vapour from so noxious an application must have inevitably prevented the process of incubation. All this, however, had no effect, the egg was opened at twelve and a half days, and no interruption had occurred to the development of the chick! The anatomical preparations illustrating these singular facts are to be found in the museum of Guy's hospital. A representation of a nineteen days' chick with the egg-shell covered as described, is annexed.



The air contained in the little space at the broad end of the egg is not apparently used for respiration during the first eighteen days of incubation. In what manner, therefore, this function can in reality be carried on appears difficult of compre-

hension. It is certainly desirable that a larger number of experiments, similar to those of Mr. Towne, should be made.

The air contained in the air-follicle is apparently intended for the use of the chick as soon as its lungs begin to come into action, which is generally about the nineteenth day. At that period the first evidence of the existence of life within the shell is afforded by the utterance of a feeble chirp, arising from the struggling prisoner within the calcareous prison. At that period it has succeeded in penetrating through the little membrane stretched across the air-sac, and it is now enabled to breathe the air contained in it. Under ordinary circumstances, where no covering has been put upon the egg, the porous nature of the shell must undoubtedly contribute to the renewal of this little volume of air, which is too small to supply the wants of the chick for any lengthened time. From this time forward the chick is an air-breathing creature; and, in the case of volant birds, is soon to be issued into the world where its sportings in that element will form a chief occupation of its existence.

The most interesting period in the life of the

chick within the shell is that to which we are now introduced, the period just preparatory to its escape from the egg-shell into the world. This escape is effected by its own efforts. It is highly interesting to observe it by means of an artificial incubator; and perhaps few spectacles are more gratifying to the beholder than to see his patience rewarded by the appearance of an animated little being, out of the shell which has so long been watched, without any evidence, until within the last day or two, of the existence of life within its narrow confines. In this method of incubation it is evident that no parental assistance can be given to the struggling prisoner; its exit must be from first to last the result of its own patient and persevering hammerings at the shelly walls which surround it. The observer is made sensible of the near approach of this period when he sees the egg exhibit the appearance technically called "chipped." A little piece of the shell at almost two-thirds of the way up the egg from the narrow end, indicates that the hammering has begun, and that the prisoner is soon about to burst open its cell and make its escape.

On examining the chick which has just begun

to chip the egg, surprise cannot but be felt that it is actually possible for it to make its escape in the awkward position in which it now presents itself. The chick is completely bent on itself—its feet are bent upwards so as almost to touch the head, which is bent downward toward the body; with the wings over it. Altogether it appears to be most unfavourably circumstanced, and escape by its own exertions is seemingly impossible. If we were to place a man in such a position, his case would be desperate indeed; for it may be seriously questioned whether the most expert burglar in the world could succeed in effecting his liberation if confined legs uppermost, his head resting on his chest, covered by both arms, tightly wrapped in a tough skin of parchment, and surrounded by a thick wall of plaster of Paris!

Réaumur well observes, that the shell is a kind of wall which must be broken through and pulled down, and the bill is the instrument which is to be used to break it: with the point of this the chick strikes many repeated blows. The bill exhibits a special structure fitting it for this express purpose, which has been thus described by Mr. Yarrell. "Upon the curved part of the upper mandible of the

chicken, just above the point, there will be seen a small horny scale, nearly circular, having at its centre a hard and sharp projecting point: this sharp point it is which, impelled by the head against the side of the shell, ultimately effects its perforation." After the chick leaves the shell the scale falls off, leaving only a light-coloured mark to indicate the place where it had been. Where the shell is very thick, as in the ostrich, it is probable that this horny appendage is proportionately thickened.

The result of the first strokes of the bill of the chick is a small crack, shown in the cut. The blows are often hard enough to be caught by a quick ear, and Réaumur, by examining an egg in this state by candle-light, saw the action of the chick in its endeavours to break down its dungeon wall. Some of the pieces fly off to a little distance from the egg; the chick pecks at one part of the shell until it is fractured, and then it appears to turn a little round and peck a little further on. At all



events the fracture extends round the circumference of the shell, although it is impossible to account precisely for the manner in which this is effected. A certain degree of movement appears to be possessed by the chick, which is probably assisted by the motion given by the hen to her



eggs on leaving them and returning to them. In artificial incubation this is effected by the attendants. It is not improbable also that by constantly thrusting against the side of the shell with its bill, the body of the chick may be slightly pushed round. The fracture is complete, and the

egg then presents the appearance represented in the cut.

The time occupied in this labour varies considerably. Some, as we are informed by Réaumur, are able to come out of their shell in an hour after they have commenced chipping; others not for two or three hours; most commonly it is the task of half-a-day. Sometimes it extends over two days. This variation depends on the variable

strength and vigour of the chick, and partly also upon the variable thickness and density of the shell. It has been stated that toward the completion of incubation the shell becomes more brittle than at its commencement; the statement, however, requires additional evidence for its confirmation. Very often the fracture does not extend all the way round the shell. It is frequently only prolonged to about three-quarters of the circumference. The lining membrane is of course separated as well as the shell; the latter, however, commonly flies off the membrane in small pieces, the membrane being broken through by a subsequent impulse of the bill.

The prisoner is on the eve of effecting his escape! "He thinks he has," says Réaumur, "and he has in reality, strength enough to separate the fore part, or largest end of the shell, from the other at the instant when they no longer adhere to each other, but by a small portion of the circumference. If his bill is no longer wanted to complete that separation, the chicken brings it about more efficaciously and more speedily by applying the whole mass of his body. He makes an effort by stretching out his feet to push his body a small

matter forward. He no sooner succeeds in this, but his body lifts up the portion of the shell it meets in its way. The chicken, by thus continuing to push his body forward,—and he repeats this action several times,—forces the foremost portion of the shell to rise more and more. He at last tears all the fastenings, or if any of them hold out, if any part of the membrane refuses to break, it becomes as to the portion of the shell, what a hinge is to the cover of a pot, it is turned up and supported by it, and so does not in any way incumber the aperture necessary for the chicken to come freely out at. And so the prison being broken open, the chicken escapes into the world.”

Generally the part of the broad end which is here described as occasionally constituting a sort of hinged door, lies by the side, or a little in front of the egg. But it is sometimes placed in a very singular position. Mr. Jesse alludes to this in the case of the eggs of the partridge. He says: “It is a curious fact, that when young partridges are hatched and have left the nest, the two portions of each shell will be found placed in each other; and I believe that this is invariably the case. If the old birds perform this operation, it is difficult

to assign a reason for it." Réaumur long since noticed the same fact, and gives the following explanation of it. He says it happens very often, that the portion of the shell alluded to is placed in a very extraordinary manner. We may look for it, but unless we know where to look, we shall probably not find it. It lies within the hind part, just as we ourselves often put one empty cup within another. When the chicken is just born, the fore part of the shell stands before him, and he pushes it back with his feet without any intention or need to do so, and thus pushes it into the other, whose cavity lies ready to receive it. The cut represents the two pieces of the shell in this position.



The conduct of birds during incubation has been already adverted to; but it may not be out of place to give here a singular account of a turkey-hen, related by the last-named naturalist. He says that there are no fowls so perseveringly willing to sit as these; and he made the attempt to turn this inclination to some account for the

hatching of poultry. Several turkey-hens were kept sitting at one time; and, as fast as some eggs were hatched, others were placed under the bird. Some of these had the patience to remain incubating for above four or six months at a time, or even longer! Frequently, also, they would sit without any eggs being in the nest. The perils to which the young chicks are exposed during this period are very great, arising from the great weight of the turkey, so that in getting on or off her nest she is apt to crush the eggs, or otherwise injure them. It appears, however, that others besides Réaumur have availed themselves of the turkey-hen's disposition to sit; for it is said, that the persons who breed early poultry for the London market, and who have, it is said, a secret for preserving the vital property in eggs laid in the spring and summer, till late in the autumn, put them under turkeys which are kept sitting for this purpose. These persons chiefly reside near Chertsey, in Surrey, and the neighbouring country: and the secret for preserving the eggs in a proper state for hatching is strictly preserved among them. Mr. Jesse says he has visited one of these cottages, and found the room surrounded

with small square pens, in which the turkeys were sitting. They are occasionally taken off the nest for a short time, and then returned to it.

The most curious part of Réaumur's account, however, is the following. A turkey had destroyed a number of eggs committed to her for incubation in a very singular and apparently inexplicable manner. She had built her nest in a place raised a foot and a half from the ground, between a wall and a dog-kennel, under shelter. As Réaumur never caused eggs to be set upon by turkey-hens for any other purpose than experiment, some notes or writing of some sort were almost always written upon the shell. One morning, to his great surprise, he found in the middle of the yard two of the said superscribed eggs, that were of the number of those entrusted to the turkey-hen. It was impossible to comprehend by what means these eggs could have been thus carried to the distance of more than fifteen or sixteen yards from the nest. In reality this was done by the turkey-hen herself. Réaumur was so fortunate as on one occasion to surprise her in the very act of removing an egg: she was holding it in her bill, and she took it and gently laid it

down, after which she returned again to her post. Several other times she was seen performing the same singular act. It appears, that this turkey took offence at being called upon to incubate too many eggs at once, and, in order to relieve herself of the charge, adopted this method of getting rid of them. More frequently, however, she broke them when they exceeded a convenient number.

The dangers to which the chick is exposed during the period of its life in the shell arise chiefly out of the carelessness or misbehaviour of the hen-bird, or from the attacks of enemies from without, of various kinds. The mother, after continuing with the usual patience to perform her duties of incubation, appears sometimes to become weary of the monotonousness of her existence; and evil is then sure to befall the unhappy half-developed chick. When this is the case, she will abandon her nest and leave the eggs to perish for lack of warmth, or falling upon them she will break them with her beak. Sometimes this act of parental cruelty is done only a few days previous to the birth of the chicks; the shells are mercilessly broken, the tender body of the chick is exposed to the air

much too soon, and its death is the result. The poultry keeper is only too well acquainted with these instances of bad conduct on the part of the parent birds, occasionally losing valuable eggs in consequence of the caprice or cruelty of the parent. In nature such accidents as these must be far from common, as the naturalist seldom finds a nest of eggs deserted, or its beautiful fabric deformed by the mangled remains of the young slain by their own parent. It may seem, however, to redeem the character of the domesticated fowls, in some degree, from the charge of cruelty, if we adopt the amiable view proposed by Réaumur, who seemed to fulfil the law of charity even towards the animal world, and was fond of thinking the best even of the worst apparent misconduct. He seems to consider that very often the parents do not do it out of ill-will, but simply out of impatience, and desire to see the little beings over which they have so long kept a faithful watch! Sometimes the parent bird, however, will eat up the egg after breaking it, which places her conduct in a very suspicious light on the score of kind impatience. Man himself is very frequently the cause of death to the chick while yet in the

shell, but in an indirect manner. The parent bird has absented herself for a brief time to recruit herself by food and exercise, when she is unfortunately descried by the gunner. In a moment she is struck with death, and drops bleeding and fluttering to the earth herself; perishing indeed, but not alone. The nest may be found hard by, and none of the pretty objects it contains will now give birth to the offspring of this murdered mother. Sometimes, too, an unfortunate chance reveals the nest with its treasure to the eye of the wandering schoolboy, and then woe to its contents, and misery to the wretched parent on her return to her ruined homestead.

But the eggs are threatened with other dangers than these, arising from their being preyed on by rapacious animals, or by birds. The magpie has a bad name among country people for this vice. Mr. Knapp says they will occasionally plunder the nests of other birds; and we find in early spring the eggs of our out-laying domestic fowls frequently dropped about, and robbed of their contents. That the magpie is a party concerned in these thefts we cannot deny; but to the superior audacity of the crow we attribute our principal injury.

However the magpie may feed on the eggs of others, it is particularly careful to guard its own nest from similar injuries by covering it with an impenetrable canopy of thorns, and is our only bird that uses such a precaution, securing it from all common depredation, though not from the hand of a bird-nesting schoolboy. Audubon relates the same fact as to the thievish conduct of the American crow. The most remarkable feat of this crow is the nicety with which it pierces an egg with its bill, in order to carry it off and eat it with security. In this manner it has been seen in the act of stealing, one after another, all the eggs of a wild turkey's nest. Sometimes, however, this theft is retaliated upon the American crow by the jay. When in the Bay of Fundy, Audubon watched several mornings in succession a theft of this kind. A jay sat patiently observing the departure of a crow from off her nest, and as soon as the coast was clear, the jay immediately repaired to the nest and carried off the egg. The blue jay, a splendid robber of the most graceful proportions, arrayed in the most beautiful garb, and altogether an elegant and charming bird, to all appearance, is described by Audubon as a being full of selfishness, duplicity,

and malice. The thrush, the mocking-bird, and many others, although inferior to him in strength, repel him from their nests; but he waits their absence, and creeps silently to their retreat, and



The Blue Jay of America.

then devours the eggs or young without compunction. This bird has been seen going its round from one nest to another every day, and sucking the newly-laid eggs of the different birds in the neighbourhood, with as much regularity and composure as a physician would call upon his patients! Yet in returning from its predatory tour to its own home, it has found a just retribution in the snake which has seized upon its partner and her eggs, and destroyed both. Audubon makes the droll remark; "I have thought more than once upon such occasions, that, like all great culprits,

when brought to a sense of their enormities, it evinced a strong feeling of remorse."

The common belief that the extrication of the chick from the shell is assisted by the parent bird, has been already alluded to; and it may be here repeated, that such assistance does not actually appear to be given in the generality of cases. Sometimes, however, it is customary to render human assistance to the little prisoner with a view to extricate it out of its shell. Many country people have the custom of attempting to soften the shell, and so facilitate the escape of the chick. This they attempt to do by the not very rational process of dipping the eggs in warm water, and keeping them in it for some minutes on the day previous to that on which the escape of the chick is expected. It need scarcely be said, that such a process is in vain with such an object in view, nor does it appear that any other good result attends the practice. Sometimes a little manual assistance in extricating the chick has been found useful. The shell is occasionally too hard, or the chick is too feeble to break it through; in such cases the attempt has been made to take off the broad end of the egg, upon which the chick

escapes with readiness from its prison. Occasionally, the chick is glued to the shell, and gentle separation has been found useful; but in the generality of instances it is best to leave all to the natural method, and the chick will very commonly make its own way best and safest out of its prison-house. A very little injury inflicted on the chick at this juncture proves fatal to it.

It need scarcely be remarked before closing this chapter, that all eggs are not necessarily productive. If a fertile egg be kept beyond a certain time, it cannot any longer be reared either naturally or artificially to give birth to a chick. Even the earliest development of the chick will not take place. It appears that by constantly turning every day during the time they are kept, eggs fit for incubation may be preserved in that state longer than they would otherwise be. If this is correct, it is difficult to account for the fact: the common explanation given is, that the turning prevents the adhesion of the contents of the egg to its lining membrane. As to the secret alluded to in a previous paragraph, it is impossible to state its nature; but it is probably some simple process like that just mentioned, combined with keeping

the eggs in a cool place. Some eggs, in consequence of a defect in their physical structure, however newly-laid, will produce no chicks; this, however, cannot be foreseen from their external appearance.

The third stage in the life of a bird is thus brought to a close. In all the facts upon incubation, in all the mother's anxiety and assiduity during this period, in all the wonders of opening life, and in its progress to the development of the animated being from the apparently inanimate egg, there is abundant matter for our attentive consideration and thought. And mysterious though the subject still remains, after all that the most profound philosophy has attempted to do in the way of explanation, we have evidence in all of the wisdom, nor less of the goodness of God both in and towards all his creatures. If a philosopher were shown an egg or a seed for the first time, if he were acquainted only with birds and plants, as they appear in their complete forms in the fowl of the air and the tree of the plain, what would be his astonishment at learning that the seed and the egg were but the early conditions of those forms of organic life, and that on the application of a few

simple external agents, a principle of life at present dormant within both would develop itself, until it had produced in the one case the flying fowl, and in the other the waving tree. This would fill him with surprise ; let the thought then awaken within ourselves that admiring and adoring love, which all creation is calculated to excite toward its great and glorious Author. To the final changes in the life of the bird the next part is intended to conduct the reader.



The Young Family.

PART IV.—THE YOUNG BIRD.

CHAPTER I.

THE NESTLING.

THE egg-shell is burst open; the prisoner of three weeks, or a fortnight, or a month, or even longer, if it belongs to the swan family, has effected its deliverance, and commences life. With what joy to its parent, when one only has shared the toil of incubation, or to both, when both birds have by turns tended the development of their offspring in the act of incubation! In contradiction to what is generally believed with regard to the extrication of the chick, Audubon states that he has seen the mother rendering help to its emergence. Since we do not remember to have met with any similar statement, we shall quote Audubon's words from his own volume. He says:*

* Audubon's Ornithological Biography, vol. i. p. 7.

“I once witnessed the hatching of a brood of turkeys, which I watched for the purpose of securing them, together with the parent. I concealed myself on the ground, within a very few feet, and saw her raise herself half the length of her eggs, look anxiously on the eggs, cluck with a sound peculiar to the mother on such occasions, carefully remove each half-empty shell, and with her bill caress and dry the young birds that already stood tottering and attempting to make their way out of the nest. Yes, I have seen this, and have left mother and young to better care than mine could have proved,—to the care of their Creator and mine. I have seen them all emerge from the shell, and, in a few moments after, tumble, roll, and push each other forward with astonishing and inscrutable instinct.” Although the terms in which this anecdote is expressed are somewhat obscure, yet it appears as if they were intended to convey some idea of the mother’s rendering assistance to her escaping chicks.

A period of new cares is thus opened upon the affectionate parents. These little beings, so fresh born into a rough world, are too tender to endure much exposure, and the parental task of covering

them until they are able to support the severities of the weather uninjured, is still continued. Among a large number of birds this is the case. The little chick almost as much requires the fostering heat of the parent's breast as did the egg from which it has just emerged. In such cases it is customary for the parent bird still to cover her nest. The titmouse, our most constant orchard companion, does so in an interesting manner. At the expiration of a fortnight her young are all hatched, but the mother still sits upon them several times during the day, and probably also during the night. This time is gradually shortened, so as to harden the constitutions of her tiny offspring, upon the same principle as that on which mothers of our own species cause their children to leave off flannel clothing, by tearing a strip off every day, until a mere rag is left, which is at last committed to the flames. So the blue tit gradually shortens the time during which she communicates warmth to her young ones, until at length they are sufficiently fledged not to require such protection. It is said that a number of the smaller birds sit upon their young during the night after they have ceased to protect them during the day.

Words cannot better express the helpless condition of the chick, and the lively solicitude of its parents, than does the following account, written by the great American ornithologist, of the ruby-throated humming-bird at this interesting period of its life. "Could you, kind reader, cast a momentary glance on the nest of the humming-bird, and see, as I have seen, the newly hatched pair of young, little larger than humble-bees, naked, blind, and so feeble as scarcely to be able to raise their little bill to receive food from the parents; and could you see those parents, full of anxiety and fear, passing and repassing within a few inches of your face, alighting on a twig not more than a yard from your person, waiting the result of your unwelcome visit in a state of the utmost despair—you could not fail to be impressed with the deepest pangs which parental affection feels on the unexpected death of a cherished child. Then how pleasing is it, on your leaving the spot, to see the returning hope of the parents, when, after examining the nest, they find their nurselings untouched! You might then judge how pleasing it is to a mother of another kind to hear the physician who has attended her sick child assure

her that the crisis is over, and that her babe is saved."

Were we to look into the nest of an eagle at the time when the young are just hatched, an experiment of no little peril, in the experience of any who have had the opportunity, and have made the attempt, and contrast the young ones newly-born with those of a barn-door fowl's nest of a similar age, a most striking contrast would present itself. None would say from their appearance that the young of the eagle were likely to be superior to the common chickens in point of physical strength and courage. At present, the young chickens, or ducklings, though having a milder and more placid expression of face, are decidedly the superiors to the young princes of the feathered tribe. The latter are feeble, trembling, naked, or nearly naked, and altogether blind beings, the most helpless and dependent of all creatures, and the least apparently able to resist the severities of the life upon which they have lately entered. The young chickens, on the contrary, are very lively in a little while after their emergence from the shell, are able to run about, and, with an almost ludicrous attempt, they

can imitate the actions of the parent bird in scratching up the ground, and then sharply trying to inspect it in the search for food. No conditions can be more opposite than these. In the one the bird appears in a well-developed state, and capable of exercising many of its faculties; in the other, the poor weak and helpless creature presents us with a spectacle of debility and apparent imperfection. In one or other of these two conditions a very large number of birds are when young; either they are excluded from the shell, feeble, naked, blind, and dependent on their parents for support, or, on exclusion, are able to run about, and provide food for themselves the moment they quit the shell. This fact, which has a very general application, has been made the basis of a system of arranging birds into two divisions; the one containing those the young of which are in one, the second in which they are in the other, of these two conditions at birth. It does not, however, appear that this division is true to nature; and it has not, in consequence, obtained acceptance among the most learned in ornithological science. A recent attempt has been made, in the pages of the Zoologist, to call attention again to this

binary division of birds; but it is proper to state that the fact was some years previously adverted to by Professor Owen, in the *Cyclopedia of Anatomy and Physiology*.

Of the appearance of the young chick of the domestic fowl just after its emergence from the shell, we have the best account in the pages of that excellent French naturalist, Réaumur, who entered into the minutest particulars of every subject to which he directed his attention. He says: "When we see a chicken for the first time in that condition,—that is, just emerged from the shell,—we have no opinion of him; we judge that his stock of strength is exhausted by the efforts he has made, and we think him almost ready to expire. Some time after, and indeed in no long time, he appears quite another creature. All his parts gather strength. After having dragged himself on his legs for a little while he becomes able to stand on them, to lift up his neck, and bend it in various directions, and, finally, to hold his head straight. The feathers he is covered with are only a fine down, and whilst they remain wet they make him appear almost naked. These sorts of feathers seem by the multitude of their branches

to be like so many small shrubs, which when wet stick closely together and occupy very little room; but as they dry they untangle and part from each other. The branchlets, or rather the beards of each feather, were kept pressed close together by a kind of membranous tube which surrounded them. As the chick dries, the tube cracks, and the beards, springing from each other, spread out. When this is effected, each feather now occupies much more room than it previously did; and when they are quite dry and smooth, the chicken is clad in as pretty and comfortable a coat as one would desire. In a few hours after its birth the chick is as beautiful and sprightly a being of its kind as possible; its manners are so lively, innocent, and pleasing, and its whole demeanour possesses such an air of simplicity and *naïvetè* as to make it a universal favourite."

Perhaps it was the love for rearing such pretty creatures which has induced ladies more than once to carry the eggs of birds about with them, so as to warm them, and finally, as it is said, to effect their complete development. The historian Pliny relates an anecdote of the kind about the empress Livia. This lady carried a bird's egg about her

person so as to warm it, until finally the chicken was hatched. Whether it lived under the fostering care of so exalted an adopted parent, the historian has omitted to state. Réaumur was informed by a friend of his that a lady of their acquaintance carried four eggs of a goldfinch about her until they were hatched.

The young bird, as need scarcely be stated, differs much in appearance and in plumage from the old one, and this often for some time subsequently. Singular mistakes are sometimes made in consequence of this, and that by naturalists of the highest eminence. Perhaps one of the drollest and most remarkable was one made by Audubon himself. He saw two pretty birds sitting in a tree, which appeared to him to belong to some new species. He discovered their nest, and the young ones just fledged, and adds, "The scarcity of this species in the United States putting me in mind of that of true friendship among men, I have named it after my most esteemed friend, as a tribute of sincere gratitude for the unremitted kindness which he has shown me." Unfortunately, however, this new species turned out to be only the *young birds* of a very common species of

yellow-warbler. As this species was taken as a symbol of friendship, it proved unfortunately that true friendship was even more rare than Audubon thought. The mistake of an ornithologist so familiar with the character and habits of birds as Audubon was, teaches humility to us, and inculcates kindly judgment in regarding the failures of others. Such mistakes are by no means uncommon at an earlier period of the bird's history than that at which the bird in question was discovered. And we are reminded in this respect of the mistakes constantly committed by entomologists in the natural history of the spiders, the young of a well-known species being frequently mistaken for an adult of some new species. It is a well-known fact that the plumage of birds changes several times before it attains that state which characterises the adult bird. The time required for this varies from one to five years, so that, as in the instance just quoted, some birds may even rear a progeny before they acquire the same plumage as adult birds. This explains and apologizes for Audubon's mistake.

It has already been said that the young bird appears, soon after its exclusion from the shell,

clothed in down. This is the first covering of the body, and it is only a partial and a temporary one. The down consists of very fine filaments, which are wrapped together in bundles, and at first enveloped in a membranous sheath. This crumbles away after being exposed to the atmosphere, and the characteristic appearance of the downy covering is then assumed. The bundles of down are succeeded by the true feathers, which they guide, as it were, through the skin.

The appearance of the downy covering of the young of different birds varies greatly, not only from that which they assume in the adult state, but from the aspect of other young birds of the same age with themselves, but of different species. Some are entirely enveloped in down, thick and warm, while others are barely clad, a few filaments alone appearing through the tender and delicate skin which covers their bodies. To the plunderer of birds' nests no fact is more familiar than this; and if he be also a lover of the farm-yard, it cannot fail to have been observed by him, that while many of the tenants of the hedges, or breezy hill-sides, are poorly covered, the duckling, chicken, guinea-chick, and others, are dressed in

most comfortable apparel. The young chicks of several birds completely imbedded in their downy wrapping are to be seen in the national collection, and form a striking contrast to their parents, which are placed by their side.



Young Birds covered with Down.

The chick after exclusion grows rapidly, and increases in strength and vigour day by day. Audubon thus speaks of the young of the purple grackle: "And now the emerging brood shake off the shell that so long covered them; their tottering heads are already raised toward their mother,

while she with intense anxiety dries and cherishes them. They grow up day after day; the hole becomes nearly filled with their increasing bulk: the vigilance and industry of the parents also augment apace. I wish you would seek out such a sight; it would gladden your heart; for the rearing of such a family is worthy of your contemplation." The American farmers, however, do not regard this pretty picture in the same light as the enthusiastic Audubon, for it appears that the purple grackle is a little too fond of sharing the corn of the field with its proper owner; and there is little doubt, that, were he to see the happy family thus growing up only to thrive upon his golden ears, his sentiments would scarcely correspond with those which Audubon thinks his description is calculated to convey.

A most interesting and remarkable account of the ingenuity of a parent humming-bird, at this period in the life of the chick, has been narrated by Captain Lyon. The original will be found in the fifth volume of the Zoological Journal, and consists simply of an extract—far too short, and insufficient in its detail—of an observation made by this gentleman, and communicated in a letter to

a friend. "It may interest you," writes Captain Lyon, "to have an account of some young humming-birds whose hatching and education I studiously attended, as the nest was made in a little orange-bush by the side of a frequented walk in my garden. It was composed of the silky down of a plant, and covered with small pieces of yellow lichen. The first egg was laid January 26th, the second on the 28th, and two little creatures like bees made their appearance on the morning of February 14th. As the young increased in size, the mother built her nest higher and higher, so that from having at first the form of figure 1. it

Fig. 1.

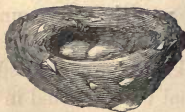
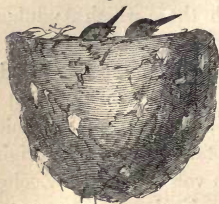


Fig. 2.



became ultimately like figure 2. The old bird sat very close during a continuance of the heavy rain

for several days and nights. The young remained blind until February 28th, and flew in the morning of March 7th, without previous practice, as strong and swiftly as the mother, taking their first dart from the nest to a tree about twenty yards' distant." We are not aware that any similar instance of maternal anxiety and ingenuity as that which led to the performance of this most interesting action of raising the walls of the nest, has been related of any other bird.

The conduct of young birds in the nest is in general tolerably amicable. The strongest, however, get most. The most prominent example of this superiority of might over right is that of the cuckoo, whose unkindness toward its poor little foster-brothers and sisters has been before narrated. Since some question has been raised by one or two naturalists, as to the accuracy of Dr. Jenner's account of this proceeding on the part of the young cuckoo, it may be useful to quote a more recent observation made by Mr. Blackwall, of Manchester. "On the 30th of June, 1823," he writes, "I took the nest of a meadow-pipit, containing a young cuckoo, which was disengaged from the egg on the 28th of the same month; and support-

ing it firmly by the side of my bed on the evening of the same day on which it was procured, very early on the morning of the 1st of July, when all was still, I carefully introduced into it eggs of different kinds in the first instance, and afterwards young birds previously selected for the purpose, and had the satisfaction of contemplating at leisure the entire process of their ejection, so minutely and accurately described by Dr. Jenner. These astonishing feats, it will be perceived, were accomplished by the nestling cuckoo when it was only three days old, and consequently before it had the use of its eyes. It died soon after, and, to me, who witnessed its exploits, it is an object of much interest, being preserved in spirits of wine to the present time." This bad conduct on the part of the cuckoo toward its feeble little fellow-nestlings can only be justified on the plea of instinct. The blind bird has probably no animosity in the world against the poor young ones which it mercilessly turns out of their home to perish at the foot of the nest. The American cow pen-bird, when young, does not appear to have the same impulse, and has already been noticed as being brought up in amity with the little birds

into whose proper home it has been intruded by its careless parent.

From an early age the future disposition of the nestling may be confidently predicted. Some are placid, docile, gentle, and easily tamed, while the qualities of others are the very reverse of these. The pilated woodpecker has been described by Audubon as exhibiting a character, even from the nestling state, of untameable wildness and even fierceness. When the young of a nest which had been watched were sufficiently old to be removed with safety, they were taken out, in order to enable Audubon to observe their habits in confinement. It was exceedingly difficult to entice these birds to open their bill in order to feed them. They were sullen and morose; and, in fact, three of them died in a few days. But the others, having been fed on grasshoppers thrust into their mouths by force, were reared.

That such should really prove to be the case—that the future character and habits of the bird thus begin to show themselves even in the nestling, is only what was to be expected. And that the natural disposition of some nestlings should differ from that of others according to the species

to which they severally belong, is as easily understood as that the disposition of a lion's whelp and of a lamb should differ from each other, and resemble that of their respective parents. The future lord of the air is as well marked in his pinnacle nest while yet a nestling, after he has attained a certain degree of development, as the future lord of the forest while yet a cub; the early manifestation of these characteristics in the nestlings occasionally gives rise to curious circumstances, when the nestlings have been reared by a foster-parent. The farm-yard is often the scene of the utmost anxiety on the part of a hen who is set in an agony of alarm by the conduct of her young brood. Happening unfortunately for her own comfort and peace of mind to wander with her newly-hatched brood near to the muddy pool which forms one of the ornaments of this locality, her astonishment and horror may be conceived when she beheld her whole brood without an exception rush into the water and begin paddling about with consummate delight. The poor foster-parent, ignorant that such is the natural habit of her brood, which turns out to be a brood of ducklings, awaits in painful anxiety their return to land, the meanwhile in

vain employing every little art to call the wanderers to her side. The ducklings, however, are in their proper element, and dabble on until, weary, or wanting food or shelter, they return to the hen and are led back to the nest. An anecdote has been related of a hen which after rearing one brood of ducklings and suffering intensely at their to her unaccountable love for water, of her own accord led down the next brood to the water in the expectation of their plunging into it as did the former one.

For two or three days the nestlings of the smaller birds remain blind. About the third day their eyes begin to uncloze, and in a few days are apparently as perfect as in the adult bird. During this period it has been observed that the nestlings lie irregularly in the nest. Just excluded from the egg-shell, and that in a feeble and helpless state, they lie without any order in their cradle, and one or two are to be found scrambling over the backs of the rest. Subsequently to this, however, the nestlings having acquired more strength and vigour, together with the function of vision, they are arranged more regularly in the nest. They now lie side by side each in its place within the nest. The object of this appears to be

to ensure each receiving its due amount of attention on the part of the parents, who might overlook one of them if placed beneath the others at the bottom of the nest. In the position they now occupy, the nestlings are conveniently placed for being fed, and also for the removal of all excrementitious matters.

Among the smaller birds, generally, habits of the most exemplary cleanliness are at this time displayed. Not very unfrequently an egg remains unhatched, or “addled;” and this, if it continues whole, may often be left in the nest with the nestlings. It has been said that birds have the power of recognising such eggs, and that they always remove them from the nest. Such, however, does not actually appear to be the case, an addle egg being, as we have just stated, occasionally met with among the nestlings. But the pieces of the egg-shell are removed; and if this egg were by the movements of the young bird to become broken, its fragments would certainly be removed, and scattered on the ground near the nest. This practice is very common among many small birds. That it is universal, facts do not at present justify us in concluding.

While the attention of the parents to the nestlings will come more properly under our immediate notice in the next chapter, yet it is not out of place to make allusion here to another evidence of the extreme cleanliness of small birds. The nestlings immediately on being fed are in the habit of ejecting the excrementitious matter. This is technically called "muting." But since such substances unless protected would speedily render the nest a loathsome place of abode, they are enveloped in a fine pellicle, which prevents this occurrence. This, however, is not all, for the parent birds immediately remove all such matters, and carry them to a distance from the nest. In this manner the perfect cleanliness of the nestlings and of their pretty abode is ensured. The nest of the song-sparrow of America is described to be a miracle of neatness and order.

Sometimes death takes place among the little family. It is to be wished that more were known about the diseases of the lower animals, birds included. Disease, however, is not confined in its attacks to the adult bird. Previous to the time when the full coat of feathers succeeds to the thin down with which many nestlings are at first

covered, it is easily intelligible that the nestlings are peculiarly liable to inflammations or fevers, originating in the dangerous effects of extremes of temperature or of wet. It has pleased the great Creator of the world, with all its beautiful systems of being, to provide against much of the risk which the nestlings would otherwise incur, in cases where the climate is constantly severe, by the envelopment of a dense coat of down; but in temperate latitudes by appointing the time for the development of the chick from its shell at that season of the year when exposure is less dangerous than at any other. The cold and rainy months of winter and early spring are times when hatching does not take place. But as the months move forward, and bring warmer weather and serener skies, the forests and fields abound in nests filled with chirping young. Even with this precaution disease will attack the chick, and it may die in the very midst of a thriving family. Sometimes this untimely death is the result of an accident. The parent in gathering her brood under her unhappily tramples upon one of them, and the poor chick perishes. This event is more common among domestic fowls than among others. Sometimes the

nestling is smothered by the others overlying it. All these are perils to which the nestling is more peculiarly exposed at the time of its first exclusion than subsequently. "The country dame," says Réaumur, alluding to the accidental death of the young chickens from accidental causes, "is very well pleased when her brood-hen, which had fifteen eggs given her, is followed by a train of eight or nine chickens after she has left the nest." Sometimes, as already noticed, the death is caused either by the bad propensities or by the impatience of the parent.

There is this difference between domestic birds and small birds generally under such circumstances. The latter, strongly acting under the instinct of cleanliness, and with a view to the well-being of the rest of their family, invariably remove the dead birds, and convey them to a distance from the nest. This is an action of which the common fowl, which is far less scrupulous as to the order or cleanliness of its nest than are the smaller birds, is said to be incapable.

It is a mistake to suppose that birds produce only one brood in the year. A number of the smaller birds produce two or three different sets

of eggs in the season. In order to rear these, frequently a new nest is constructed for each brood, but in other cases all are brought up in the same nest. A gentleman resident at Hackney has kept for some years a number of smaller singing birds in a large aviary, where among others are several pairs of skylarks. The degree of perfection in which he manages his favourites, and the total absence of any influence of fear or restraint on their habits, may be learned by the fact that in the summer of 1836 a pair of skylarks produced four sets of eggs, and in 1837 the same pair produced three sets of eggs, and reared some of their young. The song-sparrow, to whose cleanliness allusion was just made, is one of the most abundant birds in Louisiana of its tribe. This abundance is easily accounted for by the circumstance that it rears three broods in the year. The first brood generally consists of six nestlings, the next of five, and the third of three, making in all fourteen birds from a single pair in the year. If we suppose such a couple to live in health and enjoy the comforts necessary for the bringing up of their young families for a period of only a few years, it is easily con-

ceivable how a whole flock of the species may be produced; and were the original parents to be surrounded by their own direct descendants—the birds they had themselves reared, with their offspring's offspring, we may imagine what an enormous multitude of birds would then be congregated together.

The following extract from the pages of the *Zoologist* will show how some of the birds which are our most constant companions in summer, multiply around us in spite of the attacks of man:—

“*April 27, 1848.*—The young leave the first nest, built in a clump of ivy on the top of a wall; four in number, one egg having been abstracted from the nest before incubation.

“*April 29.*—Two eggs in the second nest, detected in a bushy yew tree.

“*May 16.*—The male bird observed feeding the five young, newly hatched, in the second nest.

“*May 24.*—The hen blackbird seen making her third nest in an apple tree nailed to a wall.

“*May 29.*—Two eggs in the third nest: and the brood leave the second nest, and perch on the trees.

“*June 10.*—Third nest forsaken. Of the eggs,

which were five in number, two remain in the nest, part of the others on the ground below the nest, and part found in a walk some twenty yards from it.

“*June 14.*—Blackbird’s fourth nest begun in a birch hedge.

“*June 23.*—Of the five eggs laid in the fourth nest only two remain; another found on the ground below it: it seems to have been pillaged by some bird, in the same way as the third nest.

“*June 26.*—Fifth and last nest of the blackbird partially formed in a vine trained on the end of a house.

“*July 18.*—Blackbirds in the fifth nest half-grown: they left the nest on the 26th.

“Thus a single pair of birds had twenty-five eggs, and reared fourteen young in one season. The gardens and shrubbery are so small in extent, that had there been more than one pair about them they would have been at once detected; and such were frequently looked for, but always in vain. The dates of the different stages observed also tend to show that one pair may have constructed and managed the whole of the nests with their contents, eggs being never found in more

than one nest at the same time, unless when one had been forsaken. From a careful examination of the ground around the third nest, it is inferred that it must have been some winged creature that disturbed the female on the eggs, and destroyed some of them. Was this the male?"

In attentively considering this account, it appears probable that had not the third set of eggs been destroyed, the blackbird would have produced no more than that set. And the same remark applies to the fourth. It has been already noticed that birds may be caused to lay a larger number of eggs than they would otherwise do, if by accident their eggs are destroyed or removed. In the instance in question it is, to say the least, improbable that another set would have been laid, had not the birds experienced some accidental disturbance during the period of incubation. Colonel Montagu considered that few birds, if any, would produce a second brood in the same season if unmolested. He adds,—“We have never been able with any certainty to discover either in the red-breast or hedge-sparrow, who are the earliest breeders, the production of a second brood after the first has been brought to maturity. Their

attention to the young continues long after they leave the nest. The great exertion to collect food for so many must exhaust the animal spirits, to recruit which is a work of time; so that the season is too far advanced for a second production." This opinion, however, is contradicted by facts; and it appears to be placed beyond question that many birds produce two broods or more in a season without the necessary interference of an accident to account for it—such, in fact, appears to be a law of their nature. The second brood is commonly fewer than the first; and the third, when there is a third, is fewer in number than the second. The proof that one of the birds named by Montagu actually produces more than one brood in the season, is contained in the following very pretty account of the proceedings of a pair of these birds quoted from the *Field Naturalist's Magazine*.

"A pair of robins chose for their abode a small cottage which, though not actually inhabited, was constantly used as a depository for potatoes, harness, &c. and repeatedly visited by its owners. It closely adjoined a large blacksmith's shop; but neither the noise of the adjacent forge, nor the frequent visits of the owners of the cottage,

deterred these fearless settlers. They entered through a window-frame, the lattice of which had been removed; and in a child's covered cart, which with its horse attached to it was hanging on a peg near the fireplace, and just afforded space for the purpose, they built their first nest early in the spring. The circumstance was observed, and soon became an object of curiosity to the neighbours, many of whom came to look at the nest: these inquisitive visits, however, had not the effect of alarming the birds, who here without accident reared their first brood. When the attention of the parents was no longer needed by their full-fledged offspring, they set about providing for another family, and built their second nest on a shelf on the opposite side of the room, close to an old mouse-trap. Here again they received numerous visits of inquiry from the neighbours, and reared and dismissed their progeny. This second brood had no sooner left them, than they again betook themselves to the task of building a third nest under the same sheltering roof, and for this purpose chose another shelf, in a different corner of the same room; and there in their mossy bed in a bundle of papers, on the 21st of June, were

four half-fledged nestlings, which the hen was feeding while a party was watching the proceeding, the male bird contenting himself with looking on from the outside. There could not be the least doubt that each successive nest and brood were produced by the same pair, since the identity of the hen bird was fully established by the fact of her having by some accident lost her tail, which of course rendered her extremely conspicuous, and readily recognisable."

It is now time for us to conduct the reader to a more minute account of the little being on which our attention is concentrated—the bird in its nestling state: we shall therefore proceed in the next chapter to speak in detail of its education and final history.

CHAPTER II.

EDUCATION AND REARING OF THE BIRD.

ONE of the earliest wants of the bird in its nestling state is food; and both in its collection and its distribution to the expectant young, the parent birds display an amount of affection, patience, and diligence, unparalleled in the animal kingdom. It is necessary to call to mind the fact, in considering this circumstance, and estimating the careful anxieties of the parent, that the young of the birds are entirely dependent upon the personal activity and success of the parent in the search after food. The young of mammiferous animals, on the contrary, draw their subsistence entirely from the parent, whose concern is thus limited to providing food for her own necessities. The bird has to satisfy the cravings of her own appetite, and to supply in addition the often almost insatiable mouths of a numerous family at home. The exertion necessary for this is inconceivably

great; and were it not that the ever bountiful hand of God has so thickly strown the earth with appropriate food for His feathered creation, it could not fail to be either that the mother or the young must perish for lack of food. As this reflection makes its due impression on our minds, how forcibly does it point to the inspired words:—"Who provideth for the raven his food? When his young ones cry unto God, they wander for lack of meat." "He giveth to the beast his food, and to the young ravens which cry." "These wait all upon thee; that thou mayest give their meat in due season." How true the expression!—"Thou openest thine hand, and satisfiest the desire of every living thing." Our Lord himself drew the attention of his disciples, and would direct our own, to the same beautiful evidence of the love and care of God over the creation He has made:—"Behold the fowls of the air: for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father feedeth them." To them that are his servants how strong the appeal: "Are not ye much better than they?"

A pleasing incident illustrative of the anxieties

to which the parents are at this time exposed, and their labours to feed their young, is recorded by Mr. Knapp. He says:—"I was lately exceedingly pleased in witnessing the maternal care and intelligence of the blue titmouse; for the poor thing had its young ones in the hole of a wall, and the nest had been nearly all drawn out of the crevice by the paw of a cat, and part of its brood devoured. In revisiting its family, the bird discovered a portion of it remaining, though wrapped up and hidden in the tangled moss and heathers of their bed, and it then drew the whole of the nest back into the place from whence it had been taken, unrolled and resettled the remaining little ones, fed them with the usual attentions, and finally succeeded in rearing them. The parents of even this reduced family laboured with great perseverance to supply its wants, one or the other of them bringing a grub, caterpillar, or some insect, at intervals of less than a minute through the day, and probably in the earlier part of the morning more frequently. But if we allow that they brought food to the hole every minute for fourteen hours, and provided for their own wants also, it will admit of perhaps a thousand grubs

a-day for the requirements of one, and that a diminished brood, and give us some comprehension of the infinite number requisite for the summer nutriment of our soft-billed birds, and the great distances gone over by such as have young ones, in their numerous trips from hedge to tree in the hours specified, when they have full broods to support. A climate of moisture and temperature like our own is peculiarly favourable for the production of insect food, which would in some seasons be particularly injurious, were we not visited by such numbers of our active little friends to consume it."

Mr. Hewitson records an instance in which eighteen eggs were found in a long-tailed titmouse's nest. If we imagine the whole of these to have been hatched, what a prodigious family must it have proved for a pair of these little birds to support. Among those who patronise athletic sports, a very common feat is to set a man to pick up stones a little distance apart, returning with each and placing it in a basket before picking up the next. Few persons can form a proper estimate of the vast distance which must be gone over in the accomplishment of this feat, even supposing the

farthest stone to be distant only one hundred yards from the basket. It is said that strong men come in staggering from muscular exhaustion after such exertions as are necessary to accomplish the task in a given time. Yet this is as nought in comparison of the labours of a bird to feed its young. How many trips are made in a day it is difficult to know ; but it is certain that the muscular effort expended is exceedingly great ; and were it not that the bird has been endowed with great endurance of muscular fatigue, its strength would be altogether inadequate to the fulfilment of its duties.

The gold-crested regulus, or wren, happening to take possession of a fir-tree in Colonel Montagu's garden, gave him an opportunity of becoming acquainted with its habits during this interesting period of a bird's life. The pair, as if sensible of their increased responsibilities, ceased their notes as soon as the young were hatched. This beautiful little family caused him much delight and amusement. At first there were ten in the nest, but, probably from the male not providing his share of provisions, two out of the little family perished. The visits of the

female were generally repeated in the space of a minute and a half or two minutes, or, upon an average, thirty-six times in an hour; and this continued full sixteen hours in each day. If the supplies thus brought were equally divided between the eight young ones, each would receive seventy-two meals a-day, the whole amounting to five hundred and seventy-six. From examination of the food, which now and then dropped accidentally into the nest, it was judged from the quantity weighed, that each meal was a quarter of a grain upon the average; so that each nestling received about eighteen grains of food in a day. The nestlings weighed about seventy-seven grains each at the time they began to perch; they must consequently have consumed nearly their weight of food in four days at that time. The young appeared to be made aware of the approach of the old bird by some low note, and at such times their animation was great, and every mouth was in an instant opened to receive the insect food. It appeared, however, that the strongest too frequently fared the best, these being able to jostle aside the others, and to reach the farthest. The parent bird did not seem to follow any regular plan in feeding

them. The adjoining cut represents both the bird and its nest, which is almost as elegant a specimen of bird-architecture as any that can be found.

As the young nestlings grow stronger, and a short time previous to the period when they are to bid a final farewell to their home, they do not remain in the nest to be fed, as was their habit in their early infancy. They scramble up its sides, and perching on the edge, await the arrival of their parents,

and at their coming receive each its proper portion. The young of the American robin often leave the nest and perch upon the surrounding twigs, as if they would go forth to meet their parents on their return home. One of



the immense plates in Audubon's work represents such an occurrence, and has been selected as forming an appropriate frontispiece to this Part of the Life of a Bird.

The fact, that occasionally birds become the foster-parents of others, has been already more than once alluded to in the past pages. The parent's attention to its charge in providing them with food is frequently most severely tested when she has thus to rear the young of a species different from her own. Wilson has given a lively account of the behaviour of a foster-parent and her self-adopted charge, in the persons respectively of a red-bird and a young cow-bunting. The young cow-bunting had been put by Wilson into the same cage with a red-bird, who at first examined it closely, and seemingly with great curiosity. The cow-bunting soon became clamorous for food, and from that moment the red-bird seemed to adopt it as its own, feeding it with all the assiduity and tenderness of the most affectionate nurse. When the red-bird found that a grasshopper which he had brought for the cow-bunting was too large for it to swallow, it took away the insect, broke it in small portions, chewed them

a little to soften them, and with all the gentleness and delicacy imaginable, put them separately into the cow-bunting's mouth. This careful nurse often spent several minutes in looking at and examining its charge all over, and in picking off any particles of dirt that could be observed upon its plumage. In teaching and encouraging it to eat of itself, the red-bird—

“Tried each art, reprov'd each dull delay :”

and exhibited a degree of tenderness and care which formed a beautiful instance of attachment to a helpless object out of simple benevolence, if we may apply that term to a bird.

The enormous appetites of some of these foster-children cannot but render it a hard task for their foster-parents to supply them with sufficient food. Doubtless, were more than one cuckoo's egg dropped into the hedge-sparrow's nest, in our country the bird would be wholly unable to meet the wants of the intruders. But He, who ordered all things in nature with a view to the capabilities of his creatures, never intended that the poor bird should have the double sorrow of losing her own progeny and wearing out her strength in excessive exertions to supply the

requirements of two or three intruders. It has been kindly arranged both for the foster-parent and its charge, that its attentions should be generally confined to the supply of the wants of one bird only.

The following account of the actions of a red-warbler, which had the misfortune to be selected as the foster-parent of a cuckoo, will be read with interest. "At the latter end of July, while reading in my garden," says the observer, "I was agreeably surprised to see a young cuckoo, nearly full grown, alight on the railings not more than a dozen yards from where I was sitting. Anxious to see what bird had reared this cuckoo, I silently watched his movements, and had not waited more than a minute, when a red-warbler flew to the cuckoo, who crouching down close to the tail, and fluttering his wings, opened wide his orange-coloured mouth to receive the insect his foster-mother had brought him. This done, the red-warbler flew away for a fresh supply of food. The difference in the size of the two birds was great; it was like a pigmy feeding a giant. While the red-warbler was absent, the cuckoo shuffled along the rail, and hopped upon a slender post to

which it was nailed, and which projected about eight inches above the rail. The red-warbler soon returned with more food, and alighted close to the cuckoo, but on the rail beneath him. She then began to stretch herself to the utmost to give him the food, but was unable to reach the cuckoo's mouth, who like a simpleton threw his head back, with his mouth wide open as before. The red-warbler, by no means at a loss, perched upon the cuckoo's broad back, who, still holding back his head, received in this singular way the morsel brought him." *

It cannot be doubted, that to the foster-parent her strange charge is as dear as if it were in reality her own; neither may we question the fact, that the task of supplying it with food is as pleasant to the parent as to the young fosterling. Mr. Yarrell relates a remarkable account of the common buzzard, which admirably illustrates these facts. A few years ago a female buzzard, kept in the garden of the Chequers Inn at Uxbridge, showed an inclination to sit, by collecting and bending all the loose sticks she could obtain possession of. Her owner, noticing her actions,

* Zoologist, vol. i. p. 99.

supplied her with materials ; she completed her nest and sat on two hen's eggs, which she hatched, and afterwards reared the young. Since then she has hatched and brought up a brood of chickens every year. She indicates her desire to sit by scratching holes in the ground, and breaking everything within her reach. One summer, in order to save her the fatigue of sitting, some young chickens just hatched were put down to her ; but she destroyed the whole. Her family in June 1831, consisted of nine ; the original number was ten, but one had been lost. When flesh was given to her, she was very assiduous in tearing it and offering it as food to her nurselings, and appeared uneasy if, after taking small portions from her, they turned away to pick grain. This instance is almost as remarkable a departure from the natural impulses as that spoken of in Sacred Writ—the lion lying down with the lamb ; for the buzzard is a raptorial bird, and attacks young and defenceless creatures of various kinds, which it devours as its food.

The manner in which pigeons feed their young presents a singular exception to the general rule in the history of birds. Among popular sayings

expressive of any useless action, or improbable occurrence, the expression “pigeon’s milk” frequently passes current as one of those things which exist only in name. Among some classes, however, the belief that pigeons really produce milk for the support of their progeny is entertained, and has been sanctioned by antiquity. Modern anatomists have shown, that, anomalous as the fact may appear, such is nearly the state of the case, and that the young of the pigeon are in reality fed by a milk-like secretion of the crop of the parent. In this process of feeding, the male is as much, or even more concerned than the female. The milk-like secretion with which the young are fed by these birds is found in the organ called the crop of the pigeon, which is formed in a peculiar manner so as to enable the bird to produce this fluid food for the use of its progeny. At the time when the young birds are being reared, this organ becomes much enlarged. For some time the young pigeons are fed with this substance only; but about the third day some of the common food is found mingled with it; and as the pigeon grows older the proportion of common food is increased; so that by the time it is seven, eight or nine days

old, the secretion of milk ceases in the parents, and the young are then fed on the food common to their parents also.

Mr. Jenyns, in his recently published volume of *Observations on Natural History*, has the following singular and interesting account of the manner in which the collared or African turtle acts towards its young during the time when the milky secretion is supplied to the young from the parents. Several individuals of this species being in confinement, afforded an excellent opportunity for witnessing the whole proceeding. The old bird opening its beak to the full extent, the young plunges its own almost, as it were, down the throat of its parent, whose efforts to regurgitate the required food into the mouth of its offspring are distinctly visible. But what appeared particularly singular was, the persevering and often fruitless endeavour made by the young to induce the parent to open its mouth for this purpose. This is especially the case when the young are nearly full fledged, and partially able to feed themselves, and when, perhaps, the usual secretions of the parent's crop are beginning to fail. Under such circumstances the young become a very

rebellious set, and will often chase the old birds round the cage, and again and again present themselves before their face, as often as they turn away from their solicitations; at the same time they keep up a continual flapping with their wings, utter a plaintive, whining note, and peck at the sides of their parents' bills, trying every stratagem to make them yield to their entreaties. The old birds, however, as if conscious that there was no supply, or that it was no longer needed, obstinately refuse to pay any regard to the demands made upon them: or they are not prevailed upon until after a long time, and till wearied, as it were, with the perpetual teazings of their offspring. The difficulty experienced by the young in effecting their object is greater as they advance to the age at which they are able to take care of themselves. Probably the secretion in the parent's crop is dependent upon a certain degree of excitement caused by maternal affection; and, after a time, when this excitement wears off by reason of the increasing age of the young bird, it is with difficulty elaborated. At length it ceases altogether; yet the habit of the young coming to its parent to be fed is kept up for a while. This

scene can always be witnessed by throwing a little hempseed into the cage where the young birds and their parents are confined, when as soon as ever the latter begins to feed, the young ones will be immediately by their side importuning them for a share.

The subject of the food of the young having been thus disposed of, we may proceed, in the next place, to enter into some particulars connected with their education and rearing. On this point much depends upon the habits of the parents, whose example teaches the young to act as they themselves do in the pursuit of food, or in the escape from danger. It is to be carefully acknowledged, however, that that indefinable impulse which we call instinct, and which is innate in every creature, has generally more to do than has parental influence in the instruction of the young in their various actions; and they are taught the common things necessary for them to know, not by their parents, but by Him who is the Creator of every living thing,—the Author of all nature, and the Sovereign of the universe. This is abundantly evidenced in the case of those young birds which are hatched by artificial means. To

our perceptions they seem to lose nothing in the absence of a parent of their own species; their food is as readily searched for and recognised as though they had been instructed by the most tender and anxious parent; and when they arrive at maturity such birds are not to be recognised from a brood which has had the advantage of parental care and intelligence. There is no difficulty in understanding this, inexplicable as it may appear. The necessary knowledge required by the brute creation generally has been given to them as a part of their being by Him who gave the life itself; it is independent generally of parental instruction, although the latter may be often superadded to it; and when such is the case, it proves unquestionably the more valuable to the animal. This necessary knowledge is instinct. The application of several of these remarks must, however, in the earliest days of a bird's life be confined to that division of birds to which allusion has been before made—namely, birds which when excluded from the shell can run about, see, and pick up their own proper food. The young of the other division are so entirely dependent on parental care during their infancy as to perish if these attentions are re-

moved, being unable to help themselves. We shall notice, as we proceed, several instances evidencing the parental care manifested in the bringing up of the young.

If any one will pay a visit to the haunts of the rock-breeding birds, and will attentively consider the position in which the young of the common guillemot are placed after their exclusion from the shell, he will immediately perceive its extreme peril. The egg has lain for a month upon a shelf of rock only a few inches broad; above is a perpendicular wall of cliff; below a tremendous precipice, the foot of which is wet with the ocean waters. There, after the expiration of the month's incubation, the young guillemot bursts the shell, and enters upon life. But how dangerous its position! What prospect of its making a safe descent into the waters, or retaining a secure footing on the cliff? Yet if we look down on the surface of the waves below, we shall see the young together with their parents sporting about on the water. How, we may inquire, did they succeed in getting there in safety? For a certain period it appears that the young birds remain on the shelf of rock on which they first saw

life. During this time they are fed with fish, &c. by the parent birds, but they are still unable to use their wings so as to leave their dangerous place and dabble in the waters beneath. Mr. Waterton says, in his account of his visit to the rock-bird-breeding localities about Flamborough Head, "the men there assured me, that when the young guillemot gets to a certain size, it manages to climb upon the back of the old bird, which then conveys it down to the ocean." Having carried a good telescope with him, he saw numbers of young guillemots diving and sporting in the sea, but quite unable to fly; and he observed others on the edges of the rocks, as he went down among them, in such situations, that, had they attempted to fall into the waves beneath, they would have been killed by striking against the projecting points of the intervening sharp and rugged rocks; wherefore he concluded that the reports of the rock-climbers were true.

Mr. Jesse has some singular remarks on the same subject—namely, the carrying of the young by the parent bird. He says that some Cape geese, which had nests in the old oak pollards,

near the large pond in Richmond Park, used to bring their young safely to the water. It had been imagined that they used to do this with their bills: but this explanation did not satisfy Mr. Jesse; and the following anecdote seemed to point out the more probable manner in which it was effected:—A gentleman has some high trees near a pond at his residence in North Wales, at the top of which several pairs of wild ducks breed every year, and convey their young safely to the ground. They have been frequently watched while they have been performing this operation. In every instance one of the wings of the duck appeared to be closed, while she flapped rapidly with the other, evidently for the purpose of breaking her fall. She always alighted near the foot of the tree, thus descending nearly perpendicularly. When one duck was safely landed, she went for another; and when they were all brought down, she led them to the water. This fact would seem to show that the young are not conveyed from high situations in the mouth of the parent bird, as has been generally supposed, but under the wing. Mr. Jesse adds,—“I have heard also of a wild duck which built its nest for several years in the

top of an old tower in Sussex, and always safely conveyed her young ones to the ground. I have also frequently heard of their building in old crows' nests on the top of high trees."

Mr. Selby records an instance of a somewhat similar kind, but adopts a different explanation of it. A wild duck, near his own residence, laid her eggs in the old nest of a crow, at least thirty feet from the ground. At this elevation she hatched her young; and, as none of them were found dead beneath the tree, it was presumed she carried them safely to the ground in her bill—"a mode of conveyance," says Mr. Selby, known to be frequently adopted by the eider-duck." In a note, supplied to Mr. Yarrell by Mr. Dann, occur some remarks which throw some light upon this interesting action. "There have been," says the writer, "speculations and opinions as to the mode the golden-eyed duck adopts to carry its young down from the holes of trees in which they are hatched, which are frequently twelve or fifteen feet from the ground, and at some distance from the water. That the bird does transport them is beyond doubt—there is but one person who has ever actually witnessed the manner. Mr. Nillson

was not aware of it. The Laplanders, who were frequently interrogated, were also ignorant, beyond the mere fact of the bird carrying them. The clergyman, however, at Quickiock, in Luban Lapmark, near the source of that chain of vast lakes where the Luban river flows, was once a witness. Contrary to the general character of the Lap clergymen in Lapland, this gentleman, with little to employ him, took a great interest in natural history and botany. While botanizing by the side of the lake near Quickiock, where the golden-eyed ducks breed in great numbers, he saw one of those birds drop into the water, and at the same instant a young one appeared. After watching some time, and seeing the bird fly backwards and forwards from the nest five times, he was enabled to make out that the young bird was held under the bill, but supported by the neck of the parent."

Mr. Jesse, in the fourth edition of his *Gleanings*, adds another instance to those already on record, and one of a highly pleasing character. A clergyman in Sussex was riding, during harvest-time, with two friends, towards Dell Quay, in Chichester harbour. When they had passed the toll-bar, the road

was of good elevation, and separated by a short quick-set hedge on each side from the fields, over which there was a commanding view. When in this situation, their attention was attracted by a shrieking cry, and they discovered a pair of sky-larks rising out of the stubble, and crossing the road before them at a slow rate, one of them having a young bird in its claws, which was dropped in the opposite field at a height of above thirty feet from the ground, and killed by the fall. On taking it up, it appeared to have been hatched about eight or nine days. The affectionate parent was endeavouring, unfortunately without success, to convey its young one to a place of safety, but its strength failed in the attempt.

The young of the swan are frequently carried on the back of the female swan while she is sailing about in the water. The female is described to assist her young cygnets in mounting upon her back by raising her leg. In St. James's park during summer this manœuvre may be frequently witnessed; and the old bird with her charge on her back presents us with a spectacle as curious as that of a gipsy with her young in the same position; only the bird is the more graceful of the

two. "Living on the banks of the Thames," says Mr. Jesse, "I have often been pleased with seeing the care taken of the young swans by the parent birds. Where the stream is strong the old swan will sink herself sufficiently low to bring her back on a level with the water, when the cygnets will get upon it, and in this manner are conveyed to the other side of the river, or into stiller water."

The hooded-merganser is said by Audubon to be also in the habit of carrying her young to the water. These birds rear their young in the holes of trees on a few dried weeds and feathers. They are gently carried in the bill of the mother to the water as soon as they are sufficiently advanced. The affectionate parent then leads her young among the tall rank grasses which fill the shallow pools, or the borders of creeks, and teaches them to procure snails, tadpoles, and insects. "On two occasions the parents would not abandon the young, although I expected," says Audubon, "that the noises which I made would have induced them to do so: they both followed their offspring into the net which I had set for them. The young all died in two days, when I restored the old birds to liberty. The female, when she sees her young in

danger, repeats the syllables—*croo, croo, crooh*, six or seven times in succession.”

Instances of this kind are rare among birds, and have received little attention at the hands of ornithologists; but they are deeply interesting to all who love to trace the strong affections of a parent even in the action of a being so humble as a skylark or a duck. The parent's care in leading forth her young has long been the subject of familiar notice and observation. The actions of the wild turkey of America are thus vividly described by the great naturalist of the American woods. “Before leaving her nest with the young brood, the mother shakes herself in a violent manner, picks and adjusts her feathers, and assumes quite a different aspect. She alternately inclines her eyes obliquely upwards and sideways, stretching out her neck, to discover hawks or other enemies, spreads her wings a little as she walks, and softly clucks to keep her innocent offspring close to her. They move slowly along, and, as the hatching generally takes place in the afternoon, they frequently return to the nest to spend the first night there. After this they remove to some distance, keeping on the

highest undulated grounds, the mother dreading rainy weather, which is extremely dangerous to the young in this tender state, when they are only covered with a kind of soft hairy down of surprising delicacy. In very rainy seasons turkeys are scarce, for, if once completely wetted, the young seldom recover. To prevent the disastrous effects of rainy weather, the mother, like a skilful physician, plucks the buds of the spice-wood bush, and gives them to her young. In about a fortnight the young birds, which had previously rested on the ground, leave it, and fly at night to some very large low branch, where they place themselves under the deeply-curved wings of their kind and careful parent, dividing themselves for that purpose into two nearly equal parties.”*

All the actions of a bird in the rearing of her family are, in certain families, well typified in the conduct of our common fowls. No one can watch a brood-hen, leading her little troop of chirping young ones down the farm-yard, or into the stubble-field, or now and then, unfortunately for the florist, across the parterres, and amid the choicest flowers, without feeling that

* Ornithological Biography, vol. i.

a beautiful example of maternal tenderness is before him. Now she will be calling them to her side to partake of some choice morsel which she has scratched up from the ground; now she will sit, that all may come and shelter under her wings; and now she walks about uttering a low clucking sound expressive of her affection towards her young, and impressive of their obedience to her summons. But when the hour of peril comes, when the boisterous dog flies towards her as if he would swallow her and her young at a gulp, and, above all, when high over head the whirling figure of the hawk is descried—who shall describe her behaviour? Old John Bunyan, though no ornithologist, was evidently a close observer of nature; and he has given us, in his usual quaint style, a very accurate account of the conduct of the hen, and of her young ones under such circumstances. But One greater than Bunyan, in a few brief but emphatic words, conveys the same idea to us when, in his lamentations over the approaching downfall of Jerusalem, he exclaimed, “How often would I have gathered thy children together, even as a hen gathereth her chickens under her wings, and ye would not!”

An interesting anecdote has been related of a pair of swallows, which has reference to our present subject. In the inside of the upper loft of a mill a pair of them built their nest. They flew into the room through a broken pane in the window. As, however, the hole by which they themselves had entered was very small, it cost them a great deal of trouble to induce their young, when fully matured, to make their escape by the same aperture. Probably the young disliked the apparent danger of the experiment. As, however, there was no other outlet for them, either they must come out by this aperture, or must remain and perish. This gave their parents great uneasiness, and they appeared for a time at a loss how to induce their rebellious progeny to make a bold attempt and follow them through the broken pane. At length they hit upon an expedient which is not peculiar to *bird*-parents when the little ones prove refractory. The parents went outside and held a tempting bait in the shape of some flies just without the opening. One by one the young ones ventured to get through the opening, until finally all securely emerged. After this there was no further difficulty, as the young

birds lost all sense of fear; and, for eight or nine days, they flew out of their snug retreat every morning, and returned to it through the once formidable glass-opening to roost for the night.

When there are more than one brood of nestlings in a season, the parents very frequently take charge of their first, as well as of their subsequent families, and may be seen at times surrounded by their progeny. But a singular case has been narrated, which shows that, as is often the case in families of another species, the elder brothers and sisters took care of the second brood, fed, and finally reared them. The anecdote was originally related to the Rev. W. Bree. "At the bottom of the walk," says the narrator, "between the house and the garden, in winter runs a brook, but in summer there is only still water, which is inhabited by water-hens. The water-hens have become quite tame from persons constantly passing and repassing. This year, 1833, in the spring, a pair of them hatched some young ones; and, as soon as they were fledged, made another nest and hatched some more. The young ones of the second hatch left the old birds, and have been adopted by

the young ones of the first hatch, who have each taken one, and seem to take as much care of them as the old ones could have done. They feed them, and never leave them: only one young one has remained with the old hen."

Wilson relates of the American blue bird, that it raises two, and sometimes three broods in a season; but the mother of these respective families not being able to pay them that degree of attention which they require, the male takes the youngest brood, for the time being, under his care, while the female is again sitting.

Many beautiful anecdotes might be related illustrative of the attachment of birds to their young families at this interesting and perilous period in the life of a bird. Such self-devotion and strength of affection as is evidenced in the conduct of some bird-parents it is scarcely possible to surpass by any parallel examples of parental love among ourselves. A most amusing instance of this kind, and of the watchfulness of the male as the guardian of his mate and her tender family, is recorded of the yellow-breasted chat of America. When once aware that you have seen him, he is less solicitous to conceal himself, and will sometimes mount up

into the air almost perpendicularly, to the height of thirty or forty feet, with his legs hanging; descending, as he rose, by repeated jerks, as if highly irritated, or, as is vulgarly said, "dancing mad." All this noise and gesticulation, however, must be attributed to his extreme affection for his mate and young; and when we consider the few young produced at a time, and that seldom more than once in the season, we can see the wisdom of Providence very manifestly in having endowed him with such ardency of feeling. The attention of the intruder is thus withdrawn from the nest and its precious contents to himself, and these extraordinary manœuvres are in themselves the very means of his own preservation. A naturalist once attempted to shoot the angry bird in the midst of his mad aërial dance; but he found himself completely baffled, and was obliged to employ an Indian for that purpose, who did not succeed until he had almost exhausted all his ingenuity.

Perhaps the ingenuity to which parental affection will give rise in birds, during the period of which we are now speaking—the rearing of the young—and, indeed, previous to this time, is in no instance so conspicuously manifested as in the

interesting manœuvre so commonly known of decoying from the nest, under pretence of being wounded, or so lame as to hold out to the intruder a prospect of a ready capture. To those who are not aware of this artifice, the inevitable result is, that the invader is led far away from the nest, and then, when all chance of its discovery is at an end, the ingenious and affectionate parent bounds into the air on vigorous wings, leaving her pursuer in a transport of surprise and disappointment. The common shell-drake, which is abundantly found in the Orkneys, has got the name, very appropriately, of “sly-goose,” from the arts which the natives find it employs to decoy persons away from the neighbourhood of its nest. It frequently feigns lameness, and waddles away with one wing trailing on the ground, thus inducing a pursuit of itself, till, judging its young to be safe from discovery, it suddenly takes flight, and leaves the outwitted Orcadian gaping with surprise. The same artifice is resorted to by the dunlin, by the plover, dotterel, and peewit, and has been often adverted to by naturalists. Man, however, when it is to his interest to do so, surpasses the poor bird in manœuvring, and actually turns the arti-

fice itself into a means for the detection of the prize for which he is in quest. Peewit's eggs form a luxury which is occasionally to be found on the tables of the wealthy in the metropolis. The marshes of the surrounding countries supply a large proportion of the quantity with which the London market is supplied. Mr. Selby says that the trade of collecting them continues for about two months; and great expertness in the discovery of the nests is shown by those accustomed to it. The conduct of the female birds indicates to the initiated almost the precise spot in which the nest is placed. On being disturbed, they immediately run from the nest, and then fly near the ground, for a short distance, without uttering any cry of alarm. The males, on the contrary, are very clamorous, and fly round the intruder, endeavouring, by various instinctive arts, to divert his attention. So expert have some men become in detecting the situation of the nest, that they will often walk straight up to it from some distance; and they pretend to be able to form a pretty accurate estimate of its contents, judging by the behaviour of the female. Dogs are also trained for this express purpose; and their acquired instinct proves

often more than a match for the natural instinct of the unfortunate bird.

But, in contrast with these instances of parental attachment toward the young, we may select a few which apparently indicate a precisely opposite state of feeling. It is well known that both swallows and martins are in the habit occasionally of deserting their young. But this is under circumstances so peculiar, that we may well view the act with mingled feelings of pity, both for the parents and the perishing young ones. Mr. Blackwall, who has particularly studied this feature in the history of these birds, has given the following particulars connected with it. It appears that the late broods of the martin are those which are sometimes deserted by their parents. This seems evident from the following circumstance. A pair of house-martins, after taking possession of a nest that had been constructed during the previous summer, drew out the dried bodies of three nearly full-fledged nestlings, which had perished in it, preparatory to appropriating the nest to their own purposes. About the same time, and near the same spot, a similar attempt was made by another pair of house-martins; but all their efforts to dis-

lodge the young proving ineffectual, they entirely closed up the aperture with clay, so as to convert the nest into a sepulchre for their dead progeny. At first, Mr. Blackwall was disposed to attribute the untimely fate of the nestlings, thus unexpectedly discovered, to the accidental destruction of one or both parents; but a little reflection induced him to change his opinion. So many instances were called to mind of the sudden departure of house-martins at periods when, to all appearance, they were most busily engaged in providing for their families, that what was before regarded as the unavoidable consequence of an accidental circumstance, was now considered possibly to have been occasioned by a voluntary act of desertion. To clear up this doubtful point, several examinations were made, at the second of which, on the 22d of October, several nests, both of swallows and of martins, were found to contain dead young ones. At a third search, on the 19th of November, fourteen nests were examined; four of them contained dead nestlings; and one nest contained two eggs, whose contents very plainly showed that they had been forsaken when on the point of being hatched. A fourth search was made, on

the 11th of November, in a subsequent year, when it was found that of twenty-two nests then examined, eight of them contained dead young, amounting together to nineteen in number; and five nests contained eggs amounting together to sixteen.

Dr. Jenner, in a note quoted by Mr. Yarrell, relates a somewhat similar circumstance; he says: "A pair of martins hatched four broods of young ones in the house of a tradesman in this place, in the year 1785. The latter brood was hatched in the early part of October. About the middle of the month the old birds went off, and left their young ones, about half-fledged, to perish. The pair returned to the nest the 17th of May, 1787, and threw the skeletons out."

It is deserving of remark, that the birds which have this feature in their history are, so far as our acquaintance extends, exclusively migratory birds. It is impossible for them to remain in our country after a certain time, since exposure to its severities of winter weather would infallibly terminate in the death of both parents and offspring. Swallows, house-martins, sand-martins, and swifts, all of which have been found guilty of this act of

desertion, leave our country for warmer lands about the middle of October. It is plain that to remain with their young would result in a greater number of deaths than to leave them and provide for their own safety; no good could therefore possibly follow from the young ones being still tended by their parents,—for they would be reared only to die when the winter came. Of two evils the less is chosen; and it has been wisely ordained that the migrating impulse should at this period overcome even the strength of parental love. Let us then take compassion on the poor parents of the bird species, and, viewing their case as our own, let us see that it is only a stern and overcoming impulse which leads to the commission of an act apparently so cruel as the desertion of their helpless progeny.

Instances have, indeed, been related, which show that the poor parents are extremely reluctant to quit their offspring, and have actually tarried behind the vast migrating armies, in order to wait until they could be accompanied by their young. “I have just met with a circumstance,” observes Gilbert White, “which furnishes an exception to the whole tenor of my observations, ever since

I have bestowed any attention on that species of *Hirundines*. Our swifts in general withdrew this year, 1781, about the first day of August, all save one pair, which in two or three days were reduced to a single bird. The perseverance of this individual made me suspect that the strongest of motives, that of an attachment to her young, could alone occasion so late a stay. I watched therefore till the twenty-fourth of August, and then discovered that under the eaves of the church she attended upon two young which were fledged and now put out their white chins from a crevice. These remained till the twenty-seventh, looking more alert every day, and seeming to long to be on the wing. After this day they were missing at once, nor could I ever observe them with their dam, coursing round the church in the act of learning to fly, as the first broods evidently do. On the thirty-first I caused the eaves to be searched, but we found only two callow dead swifts, on which a second nest had been formed.” “Now, although the maternal affection of the female bird,” says Mr. Blackwall, “in this instance before us was sufficiently powerful to induce her to remain with her young till they were capable of

accompanying her in a distant journey to a more genial climate, as is sometimes the case with house-martins when deserted by their mates; yet the conduct of the male, if it does not actually establish the fact that swifts occasionally abandon their offspring to destruction, certainly affords strong presumptive evidence in its favour."

We must hasten, however, to draw this chapter in our *Life of a Bird* to its close. The nestling, as may be conceived, is now becoming a strong, vigorous, and active little being, and in a little while will equal the agility of its parents in their aërial evolutions, and in the search and capture of food. It is still carefully fed by them, and occasionally leaves its comfortable home and takes some position hard by; a step just preparatory to its being sent out into the world to provide for itself. White gives a curious account of the gradual progress of the nestlings of a swallow which had built in a chimney. He says: "The progressive method by which the young are introduced into life is very amusing; first they emerge from the shaft with difficulty enough, and often fall down into the rooms below. For a day or so they are fed on the chimney-top, and then are conducted to the dead, leafless boughs of some

tree, where, sitting in a row, they are attended with great assiduity, and may then be called *perchers*. In a day or two more they become flyers, but are still unable to take their own food; therefore they play about near the place where the dams are hawking for flies; and when a mouthful is collected, at a certain signal given the dam and the nestling advance, rising toward each other, and meeting at an angle; the young one all the while uttering such a little quick note of gratitude and complacency, that a person must have paid very little regard to the wonders of nature that has not often remarked this feat." When sufficiently advanced to take care of themselves, the young swallows are left by their parent, and, oddly enough, they immediately associate with the young broods of the house-martins, congregating with them, and clustering on sunny roofs, towers, and trees.

The time which we now conceive to have elapsed in the life of the bird has made a wonderful alteration in its personal appearance. The down has given place to a full and soft covering of feathers. The poor, helpless, wretched-looking, feeble object which emerged from the shell is not to be recognised in the plump, smooth, and lively

creature which is now all prepared to run its course of life alone. We may well wonder that the naked, or half-naked little beings, which a short time ago we beheld in their state of helpless infancy, with heads too heavy for them to support, and limbs which refused their office, so that they tumbled about in pitiable weakness, should—it may be—in the course of only a fortnight assume the vigour of full growth, and be able to dart through the air with the almost inconceivable swiftness of a meteor, and be even prepared to traverse vast continents and oceans as distant as the equator. “So soon does Nature advance small birds to their *ἡλικία*, or ‘state of perfection;’ while the progressive growth of man and large quadrupeds is slow and tedious!”*

It need scarcely, however, be here repeated, that the period of immaturity varies greatly in different species of birds. Some, as we have already remarked, emerge from the shell half matured, if we may so speak, while others long require the attendance of their parents. The latter are, however, the higher classes of birds, and approach more nearly to mammalia; while the others are the lower classes, and approach the reptiles.

* White.

When the young nestlings, or rather the young birds (for the term “nestling”—never very appropriate when speaking of birds in general, as many birds make no nest—is now no longer applicable at all) have attained this point, the connexion between the parent and its offspring is broken. With a feeling which seems in the strongest contrast to that intense attachment which has long filled the mother’s heart toward her young ones, the latter are now driven away from her side. In vain their efforts to retain some degree of the parental care towards them; the mother’s fountain of love appears dried up towards her first brood, and they are either abandoned to get their own living, or probably compelled to run away from the place of resort of their parents. Soon the tie seems forgotten on both sides; and it may often happen that, in their future lives, both the parent and the young may encounter without recognition on either part. This too, though apparently a painful measure, is necessary for the well-being of both; for in all the realms of nature God has instructed his creatures in the duty of self-reliance, man himself not excepted, save that He has also given him the revealed promise of His help likewise.

CHAPTER III.

CHARACTERS AND EXTERNAL STRUCTURE OF A BIRD.

IN drawing our account of the progress of the bird, from the nest up to the fully developed young one, to a close, we are now arrived at a period in the history of these beautiful creatures, when it becomes expedient for us to offer a brief outline of the general characters and structure of a bird, previous to our relinquishing their history altogether. It might appear that this were an almost unnecessary task, as all are familiar with the general points of structure, &c. which characterise a bird. But, although such may be the case, it will be found that there is a vast fund of information beyond the knowledge which, lying on the surface, is seized by every one. Perhaps in our own day few persons are to be found so ignorant as to confound birds with any other natural class in the whole animal world. And in fact the distinctive characters of a bird are so strongly marked, that even the ignorant in other

days could scarcely have made the mistake alluded to. Yet, under the most strange and extravagant superstition, birds were in former times supposed to have been produced by trees; and the case of the barnacle goose is an instance of this absurd and ignorant fancy. In some old engravings the bird is represented as the offspring of a tree, bearing the shells of a molluscous animal. Thus not only were the extremely opposite natural classes, shell-fish and birds, confounded together, but the animal and vegetable kingdoms were so too. Such an error is doubtless unlikely to occur in our enlightened age. Yet the student of nature ought to be well able to assign a reason for the improbability of the story, and to show that each of these forms of organic life—the tree, the bird, and the mollusk—has certain distinctive characters, which separate them to the widest possible extent from each other. Let us, therefore, pay that attention to these points in the history of a bird, which will put us in possession of such facts connected with its characteristic features as to enable us to state with precision what structural peculiarities constitute a bird, and wherein it differs from every other class in the animal kingdom.

The characteristics of a bird are given in the following very concise language by Professor Owen. "It is an oviparous* animal, with warm blood, a double circulation, and a covering of feathers. The fore-limbs, or wings, are invariably constructed according to that plan which best adapts them for the actions of flight; and although in a few instances the development of the wings proceeds not so far as to enable them to act upon the surrounding atmosphere with sufficient power to overcome the counteracting force of gravity, yet in these cases they assist by analogous motions the posterior extremities—the legs, either as in the ostrich, by beating the air while the body is carried rapidly forward by the action of the powerful legs, or, as in the penguin, by striking the water after the manner of fins, and by the resistance of the denser medium carrying the body through the water in a manner analogous to that by which the birds of flight are borne through the air. In a few exceptions only are the wings reduced to mere weapons of offence, as in the cassiowary, and in the singular apteryx of New Zealand, in which they are represented by a single spur. In no instance do the wings take any share in stationary

* Producing the young inclosed in a shell.

support, or in prehension, or seizing hold of any object."

Birds are therefore biped, and the operations of taking the food, cleaning the plumage, &c., are almost exclusively performed by means of the mouth, which consists of two mandibles without teeth or lips, sheathed with horn, in order to render more easy the seizing and other actions thus transferred to the head; the neck is elongated, and the body is generally inclined forwards and downwards from the hip-joints; the thighs are accordingly extended forwards at an acute angle, towards the centre of the trunk, and the toes are lengthened and spread out so as to form an adequate base of support. The various actions of perching, walking, running, scratching, burrowing, wading, and swimming, require for their perfect performance different modifications of the legs. The mandibles, or beak of the bird, present as many varieties of form, each corresponding to the nature of the food, and in some degree indicating the organization necessary for its due appropriation to the wants of the bird. In consequence of these variations in the feet and bill, ornithologists have founded their divisions of birds chiefly upon the modifications of these organs presented by different birds.

Thus, then, it may be rendered apparent what are the general characters of a bird, and wherein it differs from all other classes of the animal kingdom. If we were to ask, Why is a bat not a bird? a little reflection on the above sentences would furnish the proper answer. No one could say that a bat was an "oviparous animal" with a "covering of feathers;" therefore, to proceed no farther, the bat is no bird, even though it has the power of ærial progression in a degree greater than many birds. Let us, however, enter more minutely into the consideration of the general characters of a bird.

Unquestionably the most beautiful, as well as the most characteristic part of a bird, is its covering of feathers. Whether we regard the plumage of the eagle, so firm, so expansive, so majestic in movement, or that of the humming-bird glittering with a gem-like radiance, or that of the bird of paradise, which from its exquisite loveliness was supposed to have had a heavenly origin,—this covering of birds is one which has the strongest claim on our attention and admiration. Well may the elegant Paley observe, that "every feather is a mechanical wonder—their disposition, all inclined backward, the down about the stem, the

overlapping of their tips, their different configuration in different parts, not to mention the variety of their colours, constitute a vestment for the body, so beautiful, and so appropriate to the life which the animal is to lead, as that, I think, we should have had no conception of anything equally perfect, if we had never seen it, or can now imagine anything more so."

Let us speak of a single feather first, and after-

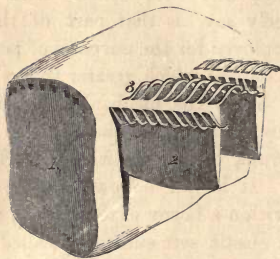


wards advert to the general arrangement of the feathers over the body of the bird. All feathers have certain general characters, which are universally applicable, whatever may be their varieties of size, consistence, and colour. The accompanying diagram represents the various parts of a feather. These parts are the quill, or barrel, (1), the shaft, (2), and the vane, or beard, (3); the vane consists of barbs and barbules.

The quill, by which the feather is attached to the body of the bird, is an admirable specimen of lightness, combined with rigidity and firmness. At the lower end is a small hole (4) leading into the cavity

of the quill, which is occupied by a number of little, delicate, and membranous pieces of a conical shape, fitting into each other. The quill, we need scarcely say, is that part of the feather which is employed for the purposes of penmanship, and by the help of which greater things have been done than by all the mechanical apparatus ever invented by man. The shaft differs in shape from the quill, being somewhat quadrilateral, or four-sided. It is not hollow like the quill, but contains, within a horny external case, a quantity of a white elastic soft substance called the pith. The vane, however, is the feather's most curious and interesting part. Here we find a most ingenious arrangement of its delicate structure, by means of which that degree of resistance to the air is offered which is necessary to the action of flight. If we take a common quill, and attempt to separate the barbs of the vane from each other, we shall find that they stick together somewhat tenaciously, as if they were, in fact, hooked together. Such is actually the case, as can be readily perceived by the assistance of a good lens, or as may be rendered evident by examining the following diagram. The barbs are thin, but stiff

pieces sticking out laterally from the shaft, and arranged with their flat faces to each other. These



1. Shaft.

2. Barbs.

3. Barbules.

are held together by the barbules, which are attached to each side of them, so that when the barbs lie together, the barbules form a series of little hooks, which hold them close to each other. In consequence of the direction in which these barbules are placed, no fastening can be more secure. It has also the advantage of being self-acting, so that when the barbs are forcibly separated from each other, the moment they are returned, and brought together again, these little hooks interlock, and all is as firm as it was before.

The lightness of feathers has become proverbial. No structure of human fabrication can be compared to them. The entire plumage of an owl frequently does not exceed one ounce and-a-half. The very largest feathers are extremely light. It is said that the largest feathers of a golden eagle do not exceed one drachm and five grains in weight, seven of them weighing not quite so much as a five-shilling piece. Yet, if we attempt to do violence to this light object, we shall find that it is fully as remarkable for its stiffness and strength as it is for its lightness. How manifestly both these properties are required in structures forming a part of the apparatus of flight! Feathers, however, differ greatly in different birds, in their compactness, &c.; and this difference is rendered necessary by the different habits of birds. Some are ever on the wing; these must have the feathers best suited for that,—some are ever on the ground, or only fly occasionally; the feathers of these birds are looser and less resisting than those of the former. We have a remarkable contrast in the compactness of feathers, if we place the quill-feather of a swallow’s wing by the side of the gaily-adorned feather of a peacock’s tail.

The texture of the feathers, particularly of the quill-feathers, has a natural effect upon the powers of flight. In the falcons, where flight is unusually vigorous and long-sustained, each of the primary quill-feathers is elongated, narrow, and tapers gradually to a point. The "web" of each feather is entire, and the barbs are closely and firmly connected together. Of so much consequence, indeed, are these feathers to the falcons, that, as we are informed by Professor Owen, when any of them are broken the flight is injured, and the falconers find it necessary to repair them; for which purpose they are always provided with perfect pinion and tail feathers, regularly numbered. In the owls, on the contrary, the plumage is loose and soft, so that they are debarred from rapid flight, which might be dangerous in the gloom in which they go abroad; yet they are thus also enabled by the same mechanism to wing their way without noise, and steal unheard upon their prey.

The feathers are known by different names, according as they are found in one or in another part of the body of the bird. Those which surround or cover the external opening of the ear are called "auriculars;" (1) those which lie above the shoulder

and arm-bone, if we may so speak, of the bird, are called “scapulars.”(2) Just below these are some



feathers which are called the “lesser coverts;”(3) those which line the under or inner side of the wing are called “under-coverts;” those which are a little lower down the wing, and just above the quill-feathers, are called “greater coverts;”(4) the

largest quill-feathers are called the "primaries,"(5) the next the "secondaries,"(6) and the third the "tertiaries." Those feathers which grow from that part of a bird's body which represents the position of the thumb in man, form what is denominated the "bastard wings."(7) The diagram will render this the more distinct. The tail must not be forgotten.

Whilst feathers are the universal characteristic of birds, it is curious that now and then cases occur, in which birds are apparently accidentally deprived of this beautiful and necessary covering. Dr. Stanley says, in reference to this subject, "A featherless canary bird was once actually reared, and lived in good health for upwards of three years. In this case the featherless state of the bird was accidental; but the fact of a bird's being able to exist without this, its natural clothing, is proved by a most cruel and barbarous custom, which cannot be too strongly reprobated, practised in some parts of England, where extensive flocks of geese are bred and reared, mainly for the value of their feathers."

It is not possible within the narrow limits of this little work to enter so carefully into the general anatomical and physiological peculiarities of birds in any part of their structure as we might

desire. We must therefore defer to another occasion the duty of discussing the change, and many other particulars connected with the plumage of birds, contenting ourselves with the simple statement, that there is a great difference between the plumage of birds in the young and in the adult state, as already noticed, and also in summer and winter. The latter fact is known to almost every person, and the alteration it makes in the appearance of birds is very remarkable in certain cases. Popularly the change of plumage in the latter case is known as the "moult."

Before passing, however, to the next part of the bird's anatomy, it may be instructive to notice the beautiful manner in which the feathers are arranged on the body of the bird. Generally speaking, the feathers are placed one over two, somewhat like the way in which slates are arranged on our house-tops. The middle of one feather is thus placed so as exactly to cover the opening left between the edges of the two beneath. In the upper part of the body of the bird the feathers are so beautifully arranged in this manner, and are at the same time so smooth and close, that they form a covering as waterproof as one of

Mr. Macintosh's coats, and combine therewith the superior property of being readily permeable to the perspiration from the skin of the bird. We are very apt to pity birds in wet weather, as if they were without any protection, but in reality they are better protected than ourselves even with great-coat and umbrella. In addition to this arrangement, it was necessary to place the feathers in such a manner as that the action of the wind from the front should tend to smooth them down, while, if the wind were blowing from behind it, should have a tendency to raise their points. Such an arrangement is beautifully displayed when we come to examine minutely the disposing of the feathers in any bird much in the air. The breast, shoulders, and front edges of the wings exhibit the most beautiful adaptation of their feathery clothing to the flight of the bird, the feathers being so placed that it is next to impossible for the wind to disturb them, take them as it may. Admirably do these various arrangements fit the bird for winging its way with the rapidity of thought through the invisible air.

In the ostrich, emu, apteryx, and some other land birds which have not the power of flight, no

such regular and beautiful arrangement as that described is necessary, at least in the degree in which it is needed by flying birds. Yet in the case of the ostrich and emu the feathers are arranged so as to facilitate the progress of the bird, and to enable it with its short wings to take a certain hold on the air blowing from behind it, which has been compared to the act of sailing. The feathers in these birds are not close and compact as in most others, but are loose and flexible; those of the singular apteryx of New Zealand, having down almost like hair, giving a very peculiar appearance to the bird. In this instance the feathers form a sort of pendent thatch well calculated for throwing off the heavy rains which fall in its native country; whilst, in consequence of the non-conducting properties of feathers, they form also a comfortable summer clothing, and afford good protection against the heat of the sun in a climate where the degree of solar power is far greater than in our own. Such a bird may be said, like the snail, to be never without a good roof over its back; but such a bird, also like the snail, is condemned to sojourn on the ground, and can never taste the joys of exhilarating flight.

Our attention is next claimed by the bills of birds; of which it has been well said, that "a philosopher need not go further than this instrument in search of a proof how well the providence of God fits the means to the ends." Unquestionably, to the bird itself, or to the ornithologist seeking to become acquainted with its habits, no part of its structure is so important as this. The term popularly applied to this part of the bird's structure is "bill" or "beak;" and it may be useful to mention that both signify at least the same part of the bird, but they do not appear to be universally understood as indicative of any difference in form. The terms are incorrectly used indiscriminately for all sorts of forms of the mouth of birds. A duck's mouth is called popularly "a bill," an eagle's or a parrot's, "a beak." If we look into a bird's mouth we find that it has no teeth, but in their place is that hard and horny apparatus, which forms an excellent substitute for these, to us, necessary instruments. The jaw-bones of birds are thus provided with this horny sheath, in order to assist the bird in obtaining and crushing its food. It may therefore be readily understood, that its form and structure will vary according as

varies the nature of the bird's food. It is plain that an eagle provided with the bill of a duck would prove, if we except his talons, not a very formidable foe. And again, if the duck were furnished with the beak of an eagle, it would be of little service to it, in its hunting up the muddy waters in search of food. We may glance at a few of these varieties among the different tribes of birds.

The beak of the birds of prey which is represented in the accompanying diagram is very peculiar, and in itself conveys an idea of strength, ferocity, and of a martial character. In these birds the beak is very strong, curved, sharp-edged, and sharp-pointed. The upper of the two divisions of the beak, which are called "mandibles," is the longer, and is hooked at the end, and often has a sort of tooth at the sides. By means of this formidable instrument, which is moved by powerful muscles, the bird tears its prey with the greatest ease. The hooked tip and sharp over-hanging edge of the upper mandible are admirably adapted for taking a firm hold, and also for dividing asunder the soft parts of the prey. This sort of beak is



consequently not so much adapted for striking as for seizing and dissecting. By means of it the falcon can easily strip his prey of its feathers as neatly and with as little injury to the flesh as the poulterer. It can also cut open the birds, divide the tendons and ligaments, separate all the joints, and, if pressed by hunger, can so entirely remove the soft parts as not to leave an atom of eatable matter on the bones. Those birds which possess the tooth-like part on either side of the upper beak, such as the falcon, are considered more noble and courageous than others. The shrike, or butcher-bird, is thus distinguished; and it is well known that this little bird does not yield in courage even to the hawk, notwithstanding its small size, and comparative feebleness of wing and foot.

The next form of bill (see the figure) is possessed



by voracious birds, not equal in courage to the former, such as crows and magpies. This bill is narrow, straight, and conical in shape. It

can inflict a severe wound by thrusting; it can also

cut, and hold very firmly while the bird tugs and tears at its prey. It has been appropriately characterised as “a very serviceable bill, a bill-of-all-work, as it were; and, when properly examined, it is found to answer well with the carnivorous habit of the owner.” The raven is thus furnished, and being a denizen of many parts of the world, he is well qualified to obtain food of all kinds, and whichever may happen to be the most abundant. The bill with which he is furnished enables him under a variety of different circumstances to obtain an adequate supply of the food he requires.

In other birds the bill becomes larger, is without a hook, and is very strong and cutting. In the herons this form of bill is straight, but in the ibis it is curved downwards, while in the avocet it is curved upwards. Both these singular varieties in the form of the bill are adapted to the peculiar habits of the herons, ibis, and avocet, in their search after food. The bills of the



two latter are represented in the diagram. The birds which possess these bills are such as generally seek their food on the ground in damp places, or in water. The ibis in its splendid livery of red, a colour which has on one occasion led to a flock of these birds being mistaken for a regiment of soldiers, hunts up the reeking banks of tropical rivers, picking up, amid the ooze and sludge left by a retiring flood, the water-reptiles and other small animals on which it feeds. The more formidable prey which they cannot master with the bill, they dash with great force against the ground, or stamp to death with the foot.

Some bills which have sharp edges are so compressed as to wear a resemblance to the blade of a knife, and can therefore be only adapted to seize small objects which are swallowed immediately. The auks and puffins have beaks of this form. The form of the bill in the bird called the boat-bill is, as the name implies, very similar to that of a boat keel upwards. This bill is consequently extremely capacious, and forms an excellent box for the safe conveyance of a fish or a small reptile. The pelican is furnished with a most singular bill also. The edges of this bill,

however, are blunt, and cannot divide anything asunder: but, to compensate for this, the bill is provided with a large membranous pouch, which forms a receptacle for a vast quantity of food for the supply of its family at home. A large fish, which might flounder out of a blunt-edged beak, has little chance of escape from the pelican's mouth, in consequence of the depth of the bag into which it falls.

There is a little bird of our own country, which, in the singular structure of its bill, surpasses even the last-named strange instances. This little bird is called, from the curious form of its bill, the cross-bill; and no term could be better selected, for, if we were to look at its bill casually, we might almost imagine that some person had purposely twisted the one across the other, somewhat like a half-opened pair of scissors. We might conceive, that with such a singularly formed bill the bird would find no ordinary difficulty in picking up its food. Yet upon examining into the bird's habits, we shall discover that this scissors'-like bill is a most



useful and powerful instrument. M. Buffon, who only too frequently was guilty of attempting to criticise the works of nature, and to do so according to his own notions of what would have been best, says, indeed, that the cross-bill cannot pick up small objects with its bill; yet, on the contrary, it appears that the bird can pick up the smallest seeds, and even shell and bark hemp and similar seeds, with as much facility as other birds. Cross-bills are found chiefly in pine forests, where they live upon the seeds of those trees. These seeds are contained in the cones, concealed under tough woody scales, which continue pretty close for some time after the seeds are ripe. The peculiar form of the bill now stands the bird in essential service. The arrangement of the muscles moving it is such, that the bill actually gains, by its very apparent defect, the requisite power for breaking up these pine-cones. This they can effect with great readiness; such is, in fact, the power of their bill, that they can strip a piece of dry wood into pieces with great ease and rapidity.

The power of the bill in these birds was well exhibited in a pair of them which were kept in captivity, and of which Mr. Yarrell has given the

following account: "One of their principal occupations was thrusting out the ends of the wires of their prison, which they accomplished with great ease and dexterity. A short flat-headed nail, that confined some strong net-work, was a favourite object upon which they tried their strength; and the male, who was usually the pioneer in every new exploit, succeeded by long-continued efforts in drawing this nail out of the wood, though not without breaking off the point of his beak in the experiment. Their unceasing destruction of cages at length brought upon them sentence of banishment." In concluding his memoir, Mr. Yarrell makes the following just observations upon the wisdom of the Creator, evidenced in this departure from the general form of the bill, in contradiction to the irreverent and unphilosophical language of Buffon. "The remarks of Buffon on the beak of this bird, which he characterises as 'an error and defect of nature and a useless deformity,' exhibits, to say the least of them, an erroneous and hasty conclusion, unworthy of the spirit of the science which he cultivated. During a series of observations on the habits of the British birds, I have never met with a more interesting or beautiful adaptation

of nature to an end, than is to be found in the tongue, the beak, and its muscles, in the cross-bill."

In the majority of birds the bill forms but a very small part in proportion to the rest of the body; but there is a remarkable exception to this rule in the case of the toucans and hornbills. In some of these birds the bill is equal in length to that of the whole body. These birds present consequently a somewhat droll appearance, looking, compared with other birds, just like a person with a mask compared to his fellow-men without one. The bill of the toucan is, in spite of its length, extremely light, and the structure is



of the most beautiful and delicate kind. The outer case is very thin and elastic, yet sufficiently rigid to answer the purposes to which it is applied. The food the bill is intended to procure is principally of a soft and non-resisting kind—

insects, fruit, &c. But they do not always confine themselves to this sort of food; for in their native forests they are often seen perched on high trees, watching the moment at which old birds leave their nests, when they pounce downward upon the callow young, which they seize and devour.

The bill of the horn-bill is characterised by a most singular prominence, which juts out somewhat like a horn. It is also very large in proportion to the size of the bird, and the edge of the upper mandible is sometimes toothed like a saw. It is not known what is the purpose of this prominent part of the bill in the economy of the bird.

The bill of the parrot, familiar as the bird is to us in its state of captivity, deserves a little study. The chief uses of this bill are for the purpose of breaking hard vegetable substances, and climbing. Next to the cross-bill, it is perhaps one of the most powerfully armed birds, if we regard simply the degree of force with which it can squeeze any substance. The bill works slowly, and simply by pressure, and somewhat resembles in its action a pair of nutcrackers; but beyond all comparison it is the better cracker of nuts of the two. Several

extremely powerful muscles act upon both the mandibles, and cause them, when any object, such as a nut, is placed between them, both to press it powerfully and to give it a sort of wrench at the same time; an effect which greatly favours the action of the bill. A vast amount of force is thus combined in the smallest possible compass; and the perch upon which the parrot stands will often give evidence of the power of its bill, while the cleverness with which it manages to open its cage door, to the annoyance of its owner, will also testify to the delicate and skilful operations to which it is equally applicable. The bill is also an excellent aid in the action of climbing.

Birds which feed on insects caught while hawking on the wing, are furnished with a peculiarly formed bill, in order to assist in the capture of their prey. The bill of the common goat-sucker is a beautiful arrangement for this purpose, the bill gaping to an extreme width and depth, and furnished at the side with a delicate fringe, which retains the unfortunate insects captured. The heads of the swallow and swift are equally remarkable for this feature, a wide-gaping deep mouth: their heads, indeed, seem to be all mouth.

They fly with their mouths open, and may often be heard snapping at the insects on the way, and making a noise somewhat like that produced by shutting the case of a watch.

Those birds, on the contrary, which catch their prey by skimming the surface of the water, have a long and peculiarly formed bill; that of the bird called the skimmer has the peculiarity of being the shortest in the upper mandible, so that it obtains its food, and can in no other way obtain it, by pushing the small marine animals on which it feeds before it on the surface of the water. The common duck, as it pushes its long bill among the weeds growing in the stagnant pool, must often have been noticed to be in the habit of chattering with its bill at the same time. In so doing, it obtains the minute water creatures upon which it feeds, rejecting those matters which are unsuited to its purposes.

We may select a yet more familiar bird, as an illustration of the last variety in the form of the bill, to which we can in this place direct attention. The house-sparrow is possessed of a bill which is a perfect model of strength and usefulness. This little bill is thick and strong, sharp at the tip, and

admirably contrived for cracking the seeds or grain upon which it feeds, or for seizing the softer parts of plants, which at other seasons of the year constitute its principal support, or, indeed, for picking up any sort of tempting bit likely to prove acceptable to the little family at home, or suited to its own uses. The bills of many other of our smaller birds, though extremely minute, are admirable and perfect instruments. Let any one look at the nest of a chaffinch, or the still more delicate and well-concealed structure of a wren, and contrast it with the "little bill" which "did all" or a greater part of this beautiful work. The bill of the bottle-tit is so very short that it barely appears beyond the feathers, yet this tiny instrument is one of the most active and efficient mechanisms in the whole animal economy. It can bite sharply and hold firmly, and build beautifully. Thus, though on a very small scale, the bill of this interesting little bird is a perfect model, exhibiting the greatest degree of usefulness with the least expenditure of material and force.

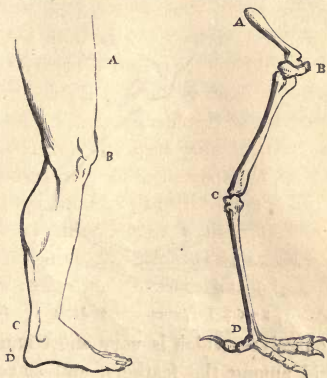
Leaving the bills of birds, we must study for a short time a scarcely less characteristic or important part of their structure—the foot. It has

been already remarked that the bill and foot prove certain useful guides to the ornithological student, in ascertaining the habits and position of their possessor in the great bird family. Not less in contrast are the feet of the eagle and those of the duck, than their bills were found to be. If we gave to the eagle its powerful beak, but gave it also the feet of a duck, it would soon be apparent how unfitted such a form of the foot was to the monarch of the air, the daring efforts of whose fearful talons have on more than one occasion snatched up helpless infants, and carried them off in the very presence of their parents, to their inaccessible home. Had the eagle a duck's foot, it might indeed swoop down upon its prey and destroy it with its powerful bill, but it could carry no portion of it away beyond that which it devoured for itself. On the other hand, we can easily conceive how ludicrous a duck would appear stalking among the peaceful occupants of the farm-yard, with a pair of the most terrible-looking feet, armed with great claws! It need scarcely be said that the latter would be quite as uncomfortable with the change as the former, particularly if it were to attempt to swim. It is plain, therefore, that the

foot requires to be peculiarly organized and formed so as to adapt it to the wants of the bird; and as the habits of birds and their food are very different, the foot, in common with the bill, as it were, reflects their differences. Had we only the foot of an eagle, we could state with some assurance that it belonged to a bird of rapacious habits; while had we merely that of a duck, we could assert with equal confidence that its former possessor was a swimming bird. These remarks are of considerable importance, for the case has even occurred in which only parts of the bodies of birds have been preserved, yet from such parts a pretty accurate idea as to the original birds themselves, and as to the peculiarities of their habits, has been obtained.

Almost every person falls into a very natural mistake about the structure of a bird's leg and foot. That part of the bird's leg which is apparently in the place of our shin bone, is generally considered to be analogous to it, or, in other words, that part of a man's leg which extends from his knee to his ankle, is taken to be represented in the bird by the part which is marked in the diagram c d. The two figures represent respectively the

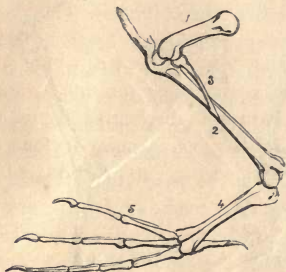
leg of a man and that of a bird, in which the corresponding parts are marked by letters. The great difference between the limbs of birds and human beings consists in this, that what we are



apt generally to term the leg of a bird, is in fact the part which answers to our ankle.

The next diagram, which represents the leg of the diver or loon, will convey the best idea as to the real structure of a bird's leg. From this it is evident that we may divide the leg of a bird into three parts. The first, or thigh, analogous to our

thigh bone, the second representative of two leg bones in man, the third representing his ancle, and the fourth representing his foot. The first part or thigh of the bird consists only of one bone



1. Thigh.

2 and 3. Leg-bones.

4. Ancle.

5. Toes.

as with ourselves, which is very short and strong, and is hid among the feathers, and so concealed that many persons are not even aware of its existence, except those who have to study anatomy at the dinner table. The next part of the leg consists of two bones, as in fact our own leg bone does. But these are separated only at the upper part, being both grown together at the lower end, so as to form a single shaft. The third part con-

sists of the ankle bones, which in the old bird are generally united into one bone; and the fourth part represents the toes, which vary in number in different birds. Hence it is clear that birds walk upon their toes, which part forms only a small portion of the foot or walking surface in man. The naked parts of the legs of birds are defended by a thick covering of scales, which are often arranged in an extremely curious and beautiful manner, and are even distinctive of the family to which the bird belongs, in many instances.

Glancing now at the various forms of the legs as adapted to the varying habits of birds, we may select that of one of the falcons as being fully as characteristic as is the head of a bird belonging to this "noble" family. These feet, represented in the cut, are eminently clutching feet, adapted to seize on and safely carry any object upon which their owner may pounce. How powerful the claws which defend the ends of the four toes, how massive and steady the general aspect of the foot! The muscles which act upon these talons draw them all together to a central point, so that there is little chance of escape for any victim into whom they have once entered—its

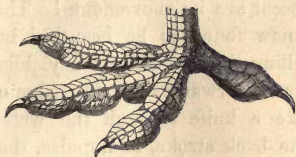
struggles only rendering the extrication of the claws the less easy—death the more painful and



Foot of Raptores.

certain. In extreme contrast with this fearful instrument is the singularly formed foot of the common coot. This foot appears as if it belonged to a bird which had sometimes to walk, and sometimes to swim, and both equally well. The coot has often to perform both these actions, and

frequently to run over aquatic plants, so that its toes are very long, while they are at the same



Foot of Coot.

time provided with a sort of approach to a paddle in the thickened parts attached to their sides.

Perhaps the most beautiful form of foot, if we regard its admirable mechanical adaptation to the purposes it is intended for, is the swimming foot. It would require a very small amount of acuteness to state the purposes for which a duck's or a goose's foot was intended. The web between the toes, stretched across in the manner so familiar to us, evidently points to the fact that its possessor is a bird whose life is spent upon the water, for which it is so admirably adapted. Among a variety of other forms of swimming feet, the foot of the grebe deserves our notice. These birds are never found far from the water; and, though able to walk

on land, they do so with some difficulty and with a peculiar gait, showing that their proper element is the wave, and not the land. But in the water how different are its movements! The singular feet are now found to be beautiful instruments for propelling the bird along the yielding surface. When drawn forwards, the thin edge of the foot passes like a knife through the water, but in giving the back stroke, or impulse, the webs are forced wide out, and thus offer a very great resistance against which the bird acts and thrusts itself onwards. In addition to this, the joints of the whole limb are so formed that it can be moved with facility in a variety of directions, and thus impel the body in any course which may be necessary to the bird in following its prey through the water. The grebes thus plunge forward with great power and speed, occasionally making use of the wings to assist them in their career.

Very different from either of these forms of feet is the climbing foot of birds. The toes in the foot of the wood-pecker are four in number, and in climbing, the two front ones act against the two hinder ones. The front claws penetrate into the crevices or irregularities of the bark, and the hind

claws tighten the hold of the foot. The foot of the parrot offers another excellent illustration of a climbing foot. The two front claws are bent sharply back, and, being extremely strong, they readily hook on to

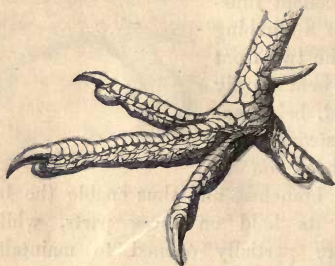


Foot of Parrot.

twigs or branches, and thus enable the bird to maintain its hold on these parts, while the wings are partially opened to maintain the balance of its body. If we were to search for an example of a good walking foot among birds, we should perhaps find the best in the ostrich. This foot, however, has only two toes, but these are both thick and strong. In walking it is lifted high off the ground; and that it forms an excellent instrument either for walking or running we have sufficient evidence in the fact that it requires the fleetest Arabian horse to hunt these birds with success. The wings are very useful in running to the ostrich, acting, as before remarked, like sails.

The foot of the common fowl is both a good walking and scraping foot, and its mechanism is

singularly beautiful and efficient. From the structure of this foot it is evident that it is well adapted



Foot of Common Fowl.

for scratching up the earth. The muscles which move the limb have considerable power in dragging the toes backward ; and as these are armed with strong concave claws, they remove the earth with great facility. But let us look at one of these birds asleep. Its perch is but little thicker than a walking stick. Yet there securely, and usually only upon one leg, the bird sleeps as soundly as we on our beds of down. The manner in which this is effected is as follows. Underneath the scaly covering of the leg, and enclosed in their

proper membranes and sheaths, lie the muscles of the fowl's leg. These are variously arranged so as to move the limb in the actions of walking, scraping, &c. But one of these, a thin muscle, sends its tendon downwards in such a manner over first the knee joint, and next the projection of the heel, that, when the weight of the body bends the leg downwards, this tendon is immediately put on the stretch, and so draws the toes firmly together, by this means not only enabling the bird to preserve an exceedingly firm hold of its perch, but also doing so without the least fatigue to the muscles of the limb. It is wonderful to think how even with this beautiful and simple contrivance the balance of the bird is preserved when it is fast asleep! The balance of our own bodies, although we have two excellently formed feet for standing, is nevertheless only sustained by a continual succession of involuntary muscular actions. When we think we are standing firmly without any muscular effort, we are in fact all the time balancing ourselves in a very wonderful and singular manner. This is the cause why when persons are suddenly taken with some fatal internal seizure, though standing perfectly still, they immediately fall to

the ground, because the power of preserving the balance has been suddenly lost to them. The impossibility of our sleeping in an erect position, unsupported, is a familiar fact. By the beautiful manner in which the leg of the bird is formed, and the exactness with which it is placed in the centre of the weight, its legs, though so slight and delicate, are, nevertheless, capable of preserving it steadily upright.

The wings of a bird, though less characteristic than the feet, for the purposes at least of the ornithologist, are interesting parts of its anatomy. It need scarcely be said that they are the representatives of the arm and hand in man, just as in the case of the legs. They consist of an upper arm-bone or *humerus*, of two bones forming the forearm, analogous to that part of the human arm extending from the elbow to the wrist, and the lowest portion consisting of bones representative of the wrist and hand in man. These bones are so formed as to give them the greatest possible degree of motion, combining at the same time great stiffness and rigidity in their structure. And when we consider the powerful and long-continued muscular efforts which put them into action during

flight, the necessity for these peculiarities of structure is the more evident. The joints are very movable, and are at the same time extremely firm and well knit together. The wing is moved by muscles placed on the bird's body as our arm by muscles on the chest, shoulder, and back, and these muscles are endowed with a surprising power of enduring fatigue. This may be readily conceived if we take a large fan in the hand and imitate the action of a bird in flying. It will soon be found that the fatigue induced by a little exertion in this way is very great. It is far otherwise in the bird, which can move its wings many thousands of times, and yet experience but little weariness. In long flight, however, such as in migration from one country to another, the poor bird's muscular efforts exhaust it, and it is often glad to seek rest in the shrouds of ships, until able to renew its journey.

The breast-bone, or sternum, forms another important part of the bird's structure, for it is here that the wings are attached, and this part, consequently, requires to be peculiarly strengthened so as to offer a firm point of action to the organs of flight. In shape, the breast-bone of a bird may

be compared to that of a boat, with a deep projecting keel. Upon it are arranged those thick and powerful muscles which act upon the wings, and one of which is in general the largest muscle in the body; in birds of flight often equalling in weight all the other muscles of the body put together. With the upper part of this bone the well-known "merry-thought" bone is connected. Two other bones are also attached to it, which are of great importance to the bird, and are exceedingly characteristic of its structure. These bones are all very different in shape in some birds from those of others, varying according to the varying nature of the habits of birds; those which are endowed with the powers of flight having a structure proportionately strong and firm, and those which live in the waters having a lesser degree of strength about the breast-bone, &c., and a greater degree about the lower parts of the body.

Before concluding this sketch of the external structure of a bird, and our little volume together, a remarkable fact about the bones remains to be mentioned. The hard material of which bones are formed consists of earthy substances and of animal matter united, and so forming a light but

strong and resisting material. The long bones in man and animals, which form the limbs, are not solid, but are filled with marrow. In birds, however, there is this remarkable difference—their bones are very rigid in consequence of their containing a larger proportion than usual of earthy matters, while they are also rendered extremely light by the free admission of air into their cavities from the lungs. Air cells thus penetrate the hollow parts and divisions of the bones, extending in different species through different proportions of the bony frame, until in some birds, as in the horn-bill, every bone of the skeleton is permeated by air. Thus, it has been well said, there is no class of animals which are so thoroughly penetrated by the medium in which they live and move, as that of birds. Even the ends of the toes are permeated by the air in the hornbills. The bones are thus rendered both light and also strong, for it is a familiar fact that hollow tubes, consisting of a certain quantity of material, are stronger than solid rods made of the same quantity of materials. The immense extension of air-cells in birds is not only important in consequence of its diminishing their weight, but also because it

enables them to breathe much more air, in proportion, than we can, in a given time, so that a degree of exertion which would put a man out of breath, has no such effect on the bird.

We have now watched birds up to their last or perfect condition. They have been presented to our notice in the act of preparing the nest, in the deposition and structure of the egg, in the duties of incubation, in the joys of parentage, in the helpless condition of the chick, and in its gradual progress to maturity. These are all facts which, in various ways, present themselves to our notice, day by day, in the fields and woods, or in the farm-yard. Yet how little do most persons attend to the lives and habits of the interesting beings of whom we have spoken! If we will only leave off the habit of thinking of the things of nature as too common-place to deserve our notice, what a fund of delightful instruction will soon be discovered lying around us, even in the most disadvantageous circumstances! It may scarcely appear credible, yet it is certainly true, that an ornithologist, even in the metropolis, has many opportunities of studying birds, as well as other matters. A gentleman, resident in the great city, has found

as many as seventy different species of birds in Kensington Gardens. Let us endeavour, therefore, to remove the veil of prejudice from our eyes, and be ever on the alert to notice the movements and habits of the commonest creatures around us, and we shall soon find our reward in the discovery of a number of minute, but interesting facts, probably wholly unknown before. Let us do so, however, in the spirit becoming those who love God, and who desire to see, in every object He has created, the evidences of His wisdom and love—attributes which all nature impresses on our attention, but which are most of all, and to man as a sinner, most importantly displayed in His word, and in the saving gospel of His Son our Redeemer, Jesus Christ.

R. E.

THE END.

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